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ANNUAL REPORTS ON THE PROGRESS OF APPLIED CHEMISTRY.

In 1916 the Publication Committee of the Society decided to issue an Annual Report on the Progress of Applied Chemistry, the object of which should be to present to the chemical technologist a comprehensive and critical survey of progress effected in each branch of the chemical industry. Such success has attended the publication of the admirable reports on pure chemistry issued annually by the Chemical Society that the need for a similar compilation to deal exclusively with the departments of applied chemistry had for some time been very apparent. Although it was realised that the Transactions and Abstracts Section of the Journal of the Society of Chemical Industry provided a valuable and most complete reference book of researches and inventions in the chemical industry, it was nevertheless evident that many advantages would be gained by preparing an annual review of progress effected. The Annual Reports Sub-Committee agreed that these sectional reviews, whilst presenting a comprehensive *résumé* of new work and ideas, should be written in the form of monographs in order to present the individual aspect of the expert compiling each section; and it was further considered advisable to change the contributors from time to time.

Vol. I. of the Report covers progress to the end of 1916, whilst Vol. II., recently published, is divided into about twenty sections, and deals with the period up to the end of 1917. The subjects dealt with, together with the contributors, are given below:—

Plant and Machinery: by J. W. Hinchley, F.I.C.
Fuel: By J. S. S. Brame, F.I.C.
Gas. Destructive Distillation. Tar Products: by E. W. Smith, M.Sc., F.I.C.
Mineral Oil: by W. J. A. Butterfield, M.A., F.I.C.
Colouring Matters and Dyes: by Gilbert T. Morgan, F.I.C., D.Sc., F.R.S.
Fibres, Textiles, Cellulose, and Paper: by J. F. Briggs, A.C.G.I.
Bleaching, Dyeing, Printing, and Finishing. by S. H. Higgins, M.Sc.
Acids, Alkalis, Salts, etc.: by H. A. Auden, M.Sc., D.Sc.
Glass, Refractory Materials, Ceramics, and Building Materials: by W. J. Rees, F.I.C.
Metallurgy of Iron and Steel: by C. O. Bannister, F.I.C., A.R.S.M.
Metallurgy of Non-Ferrous Metals: by G. Patchin, A.R.S.M.
Electro-Chemistry: by Arthur J. Hale, B.Sc., F.I.C.
Oils, Fats, and Waxes: by E. R. Bolton, F.I.C., and Cecil Revis, F.I.C.
Paints, Pigments, Varnishes, and Resins: by R. S. Morrell, Ph.D., F.I.C.
Indiarubber, etc.: by H. P. Stevens, M.A., Ph.D., F.I.C.
Leather and Glue: by Joseph T. Wood, F.I.C.
Sugars, Starches, and Gums: by T. H. P. Heriot, F.I.C.
Fermentation Industries: by Arthur R. Ling, F.I.C.
Water Purification and Sanitation: by S. Rideal, D.Sc., F.I.C.
Fine Chemicals, Medicinal Substances, and Essential Oils: by Frank Lee Pyman, D.Sc., Ph.D.
Photographic materials and processes: by B. V. Storr, M.Sc.

Although some time must necessarily elapse before these Reports can reasonably be expected to attain the standard of perfection which the Committee responsible for their compilation has set itself, it should be realised that the two issues already published represent the result of a vast amount of work, and it is confidently anticipated that industrial chemists will take full advantage of them. The volumes have been well received in the chemical industry, perhaps the greatest tribute paid being a request from the Société de Chimie Industrielle for permission to translate them into French. Suggestions for the improvement of subsequent volumes would be welcomed by the Society, and letters on this subject should be addressed to the Secretary, Dr. Longstaff.

The price of Vol. II. is 4*s*. 6*d*. to members, 6*s*. 6*d*. to non-members, post free in each case. Orders, accompanied by remittances, should be sent as soon as possible to the Publishers, Messrs. Harrison and Sons, 45, St. Martin's Lane, London, W.C. 2. Copies of Vol. I. may be obtained from the Secretary to the Society, price 3*s*. to members, 5*s*. 6*d*. to non-members.

PHYSICAL CHEMISTRY AND CHEMICAL TECHNOLOGY.

In some quarters it is customary to regard the link between physical and applied chemistry as being very slight, but the truth is that physico-chemical principles are of great significance in relation to many industrial processes. The character and extent of this relationship have lately been the subject of three Cantor lectures delivered by Prof. J. C. Philip at the Royal Society of Arts, in the course of which the bearing of physical chemistry on the chemical and allied industries was discussed.

Prominence was naturally given to matters connected with equilibrium, reaction velocity, and catalysis, and it was shown that the law of mass action, coupled with the principles of thermodynamics, permits a definite formulation of the "yield" obtainable in a chemical reaction, in so far as this depends on changes in the proportions of the reacting substances, in the pressure and in the temperature. The points at issue here were discussed in connexion with the contact process for sulphuric acid manufacture, the synthesis of ammonia, and the water gas equilibrium. In all these cases physico-chemical investigation has made it possible to express quantitatively the influence of the various factors which affect the yield of the desired product.

In regard, for example, to the influence of pressure on the ammonia equilibrium, theoretical considerations show that where the amount of ammonia formed is small, as it is at high temperatures, the volume percentage of ammonia in the equilibrium mixture is proportional to the pressure under which the reaction takes place. In conformity with this it has been found that at 800° C. and 1 atmosphere pressure the volume percentage of ammonia at equilibrium is 0·012, whilst at the same temperature and 30 atmospheres pressure, the value is 0·34, that is, nearly 30 times as great.

From the technical standpoint, a knowledge of the equilibrium conditions, however complete, does not go far enough. The manufacturer desires to know, not only what are the maximum quantities of any desired product obtainable under given conditions of pressure, temperature, and concentration, but also whether these results can be achieved in a reasonably short time. In other words, the rate factor has to be considered, and in relation to this question the systematic study of reaction velocity on physico-chemical lines is of great value.

A higher speed of reaction may be secured by a rise of temperature, but this frequently involves,

as in the case of the sulphuric acid contact process and the ammonia synthesis, an undesirable shift of the equilibrium in the direction of a smaller yield. The other recognised method of increasing the rate of chemical change is the use of catalysts, and the lecturer dealt at considerable length with this topic, showing that in heterogeneous catalysis, to which category most of the technical catalysed reactions belong, the principle of mass action is very often masked by the operation of other factors. In such heterogeneous catalysis, the rate of change appears to be determined by the velocity of some physical process, such as occlusion in the surface layers of the catalyst, and not primarily on the velocity of a purely chemical reaction. Examples of this kind are found in the catalytic combination of inflammable gas and air at hot surfaces, and in the hydrolysis of carbohydrates under the influence of enzymes.

The condition of the catalyst surface in technical heterogeneous catalysis is accordingly to be regarded as a factor of prime importance. The extent to which the activity of a solid catalyst may be affected by its previous history and by the treatment it has received is abundantly evident in connexion with the catalytic influence of nickel in the hydrogenation of oils, and that of platinum in the oxidation of ammonia. In these and other cases, notably the sulphuric acid contact process, certain substances are found to act as "poisons" for the catalyst, and these must be absent if the catalyst is to have a reasonably long life.

Another portion of the lecture course was devoted to the physico-chemical principles governing the absorption of gases and dissolved substances, and in connexion with the solubility of gases in liquids reference was made more especially to the storage of acetylene in acetone under pressure, and to the separation of carbon dioxide and hydrogen sulphide from ammonia in the working up of ammoniacal gas liquor. The features of the absorption (or "sorption") of gases by solids were also brought under review, and the special influence of the surface of the solid in this phenomenon was emphasised. When a gas is taken up by charcoal, the first stage, in which this surface effect ("adsorption") is predominant, has to be distinguished from the subsequent slow penetration of the gas into the interior of the charcoal mass ("absorption").

The phenomenon of adsorption is of significance also in the well-known effect of such materials as charcoal and fullers' earth in removing dissolved substances, notably colouring matters, from solutions. In numerous cases the relation between the concentration of the dissolved substance, (1) in the solution, and (2) on the absorbent solid, can be quantitatively expressed in a so-called adsorption formula, which is found applicable to cases of widely differing character. From this point of view the relation between a dye and an animal or vegetable fibre, the function of charcoal in the refining of raw sugar, and the retention of dissolved substances by soil, were discussed.

In connexion with adsorption, no less than equilibrium, reaction velocity, and catalysis, there are thus many points of contact between physical and applied chemistry. It may indeed fairly be claimed that, as in other branches of the science, so in technology, physical chemistry has contributed in no small degree to the introduction of quantitative, as distinct from qualitative, methods of handling chemical problems. It will be generally admitted that all factors which make for rational interpretation and quantitative control in technical processes are of the highest importance, and on this ground the closer co-operation of physical chemists and practical technologists is eminently desirable.

SOME PRESENT-DAY ASPECTS OF THE PAINT AND VARNISH INDUSTRY WITH SPECIAL REFERENCE TO THE WAR.

A. DE WAELE.

The war has been responsible for many changes in several industries, but in the case of the paint and varnish industry in particular it has produced results which should favourably influence future development. This industry is essentially one in which the inner knowledge of the mechanism of manufacture has not been furthered to a great extent by the help which pure chemistry has lent to its service. It has, however, attained a very considerable degree of perfection by the methods of empiricism. In spite of the practice of the more up-to-date firms to introduce scientific control into the factory, comparatively little progress has resulted which might be directly attributable to the influence of pure scientific research. One need not elaborate on the highly involved chemistry and physics of paint and varnish manufacture to seek a reason for this. The industry is particularly one which calls for a close collaboration between the academic chemist and his works' confrère. The furtherance of our knowledge of many problems relative to an industry which is at once utilitarian and decorative is hindered, however, by the difficulty of bringing together the work of the two schools. The "secrecy" of the industry, and the fact that the financial importance of the majority of the paint and varnish firms does not warrant the establishment of a "research department," such as we know it in many other more purely chemical industries, are mainly responsible for this condition of affairs. Our knowledge of the chemistry of the reactions occurring during the oxidation and "boiling" of drying oils is lamentably small, more attention having been devoted to the constitution of the glycerides in their raw state. In spite of this, however, the technology of the treatment of drying oils has attained a high degree of perfection, and were it possible to place at the disposal of the pure organic chemist such information without jeopardising the trade value of the processes involved, there is little doubt but that a more scientific conception of such reactions would speedily result.

As has been pointed out, the paint and varnish chemist has progressed in his work by an uncanny combination of science and empiricism. An instance of this is to be found in the ready manner in which the exacting demands of the aeroplane industry have been met in so far as paint and varnish products are concerned. With the introduction of the aeroplane as a new weapon in warfare, a problem presented itself which involved several new considerations of the resisting properties of protective surfaces. In the aeroplane we have a structure which moves quickly from a warm to a cold atmosphere, and the rapidity of transition is such that one cannot but assume that at the first entry into the freezing air, the temperature of the body supporting the protective covering must be many degrees higher than that of the protective surface itself. We have thus a case of an extreme mechanical strain on the very thin film of protecting paint or varnish. The importance of the non-failure of such protective coating on such an important part as, for instance, the airscrew cannot be exaggerated. In addition, the centrifugal force acting on the airscrew revolving at high speeds is such that an absolute state of perfection is required in the material of its construction. An important factor in the latter is the efficient protection of the sealing of the laminations of the airscrew against moisture, etc., and in view of the

considerable bending which the propeller undergoes during its rotation, the question of elasticity of the protective film is of paramount importance. The liability of the airscrew to splashing with hot lubricating oil and petrol is also to be noted. In addition to this *resumé* of the necessary properties which protective coatings for airscrews should possess there comes the economic question of speed of output in so far as application is concerned. This brings forward the old-time tenet of the varnish and paint maker to the effect that the antithesis of reliability and durability is rapidity in drying after application.

The authority responsible for the examination of aircraft products used in the war early grasped the nature of the problem which resulted from a demand for high efficiency, and wisely decided to leave the fulfilling of the necessary requirements to the discretion of the manufacturers by specifying the conditions obtaining in use, and, as far as was practicable, refraining from specifying the composition of the products to be manufactured. As a result now of expert inspection by Government technologists, varnishes and paints for aircraft are regularly supplied which efficiently fulfil the exacting requirements referred to above, whilst permitting of a rapidity of output in so far as speed of application is concerned, hitherto considered impossible.

The production of varnishes for the protection of the " dope " on wings has also proved a new and very difficult proposition, necessitating an entire revision of the preconceived ideas on oil varnish, the details of which cannot be discussed in this article. Another interesting problem which has been successfully solved is the production of an acetone-resisting paint for use on parts which come in contact with this solvent on application of the dope. The interest in this product lies in the fact that acetone has been the constituent of most commercial " paint removers."

The question of the shortage of many raw materials is one which has arisen during the present war, but with the exception of the staple raw material linseed oil, modern paint technologists had for some time past placed on a secure foundation their knowledge of the properties and uses of many substitutes for what were previously considered indispensable ingredients. Amongst these may be mentioned white lead and turpentine.

The absolute stoppage of supplies of the basic raw material of the paint maker, to wit linseed oil, for other than purely Governmental work was, however, a serious question to the manufacturers. As an alternative to linseed oil, the paint manufacturers were offered linseed oil fatty acids. Since the characteristic drying of linseed oil to a hard elastic film is intimately dependent on the triglyceridic structure of the oil, and early consideration on the paint chemists' part showed the inexpediency of relying on the commercial possibility of synthesising the fatty acids to polybasic esters, it became apparent that an absolute stoppage of the industry was threatened if the problem were not attacked on unorthodox lines. The paint manufacturers therefore formed a Federation, which decided to pool the scientific resources of its members for the solution of the problem of the adaptation of linseed oil fatty acids to paint manufacture. As an outcome of the research undertaken, many hundreds of tons of quite excellent paint have been manufactured from the fatty acids.

To turn now to a more general review of the industry, it may be noted that of late years a distinct change has been taking place in the nature of the products manufactured by the paint firms. I here refer to ordinary paint, a product which is very simply defined as heavily pigmented linseed oil. From time immemorial such a product had been generally accepted as the standard of a pigmented protective surface, in spite of its general inferiority of properties. The selection of pigments, with a view to employing the optimum of durability, had in recent years occupied the attentions of many of the technological associations. Looking at the results obtained, however, we are struck by the absence of definitiveness of the conclusions arrived at. The fact of the matter is that there is little to be done in attempting by means of the added pigment to modify advantageously the weather resistance of the medium used—raw or boiled linseed oil. One only has to call to mind what one might call the purely accidental composition of linseed oil as a mixture of glycerides of saturated and unsaturated fatty acids and the variety and amount of its soluble and volatile oxidation products to find a reason for this. After all, the oil only serves its purpose as a protective agent during a short intermediate period of its history after application, characterised by that comparatively short period when its increase in weight by oxidation is at or near a maximum. Even at this point it possesses the disadvantages of considerable porosity to air and water and giving off volatile products of an acid nature often reactive with the pigment used in a paint. That indefinite preparation—" boiled " linseed oil is little better. A certain degree of stabilisation of the molecules of unsaturated glycerides has undoubtedly been obtained by slight ring-forming polymerisation obtained during the boiling process, but a considerable impetus to further destructive oxidation has been given by oxygen absorption at an elevated temperature, with the result that disintegration of the protective film occurs if anything earlier than in the case of raw oil.

The improvement and change referred to is in the manufacture of enamels in the place of paints. Enamels are characterised and basically to be distinguished from paints in the greater stability of the medium used, a highly polymerised " stand oil " or lithographic varnish with or without the addition of an elastic weather-resisting varnish being employed. Other characteristics of enamels are the greater degree of fineness of the pigments used, and the greater gloss obtaining in the dry film. For the production of white or light coloured enamels zinc oxide is used as the base on account of its greater degree of fineness. From this there results a high gloss and a very permanent suspension of the pigment during storage, the latter being due to the formation of oil-soluble zinc soap and the presence of zinc oxide mainly in the suspensoid state, a fact which is clearly shown by the tendency of an ether-diluted zinc oxide enamel to pass through a fine filter paper. It being generally recognised that a surface of porcelain-like gloss is one of the important factors in maintaining effective weather resistance of the dried film, it was found that this was only obtainable by causing the degree of pigmentation of the product to be in the nature of half that usually obtaining in oil paints. This, and the relatively lower opacity of zinc oxide as compared to white lead, results in considerably less body or opacity being obtained in enamels. This shortcoming, however, is rectified by the employment of undercoatings of high opacity but lower degree of elasticity, impermeability, and resistance to weather than the final coat. The two latter factors do not adversely affect the general structural excellence of the whole coating, whilst the former has been shown in practice to be an actual advantage.

A class of preparation which, as the basis of protective coatings, bids fair to become a serious competitor of oil products, is the so-called flexible pyroxylin. This has for many years past been used as a substitute for the oil basis in artificial leather cloth under a registered trade name. A solution

of cellulose nitrate in solvents of comparatively high boiling-point was mixed with a substance conferring flexibility such as castor oil, nitrated castor oil, etc., the proportion of the latter being such that flexibility and chemical stabilisation were given to the unstable and inelastic film of cellulose nitrate without any of the properties of castor oil as a liquid becoming apparent. The stability of castor oil to atmospheric oxidation and its apparent inhibiting effect on the spontaneous decomposition of cellulose nitrate, rendered it particularly adaptable as the agent for securing that degree of elasticity which would allow of the film obtained comparing with an oil varnish film. Owing, however, to the necessarily low content of total solids in the solution which would allow of a working viscosity being obtained, the film yielded on evaporation is so thin that for most decorative purposes the product would not replace oil varnishes satisfactorily. Moreover, much development is needed before the cost of the raw materials used would allow of serious commercial competition with oil varnishes.

It is probable that the future developments of the paint and varnish industry will lie firstly in the direction of internal improvements in manufacture and economisation of time in the present-day lengthy processes. An appreciation of the fact that linseed oil is by no means the ideal oil to employ when accurately controlled processes are involved and more perfect and exact results are required, will lead to a more extensive investigation of the properties of oils of "simple" glyceridic structure, such as China wood oil. The recent discovery of "Oiticica" oil (Bolton and Revis, this J., 1918, 430 A) shows promise of the possibility of utilising an oil possessing the "pure glyceridic" properties of China wood oil to an even greater degree.

CHEMISTRY AT THE INDIAN INSTITUTE OF SCIENCE, BANGALORE.

The appendix to the ninth annual report of the council of the Indian Institute of Science at Bangalore (1918), contains a summary of the work carried out in pure and applied chemistry during the past session. The following information has been derived from this source.

Department of Applied Chemistry.

The chemical and bacteriological study of the fermentative production of acetone from grain has been continued, and the subjects investigated include: Analytical methods for determining carbohydrate, limits of inflammability of acetone vapour and air, purification of acetone, densities of butyl alcohol mixed with water, treatment of waste products. The bacteriological work was mainly directed to discovering the best means of ensuring sterility in the large scale fermentation, and with maintaining cultures of maximum efficiency.

The occurrence of starch, tannin, latex and sugars in mahua flowers (*Bassia latifolia*) has been investigated. The cane-sugar content increases till the flowers drop, and may reach 28·8 per cent. of the weight of dry flowers. The presence of α-dextrose, lævulose, maltose, pentoses and cellulose has been confirmed, but whether practicable quantities of cane sugar can be obtained has not yet been decided. The analytical results show that in the growing stage lævulose is always present in greater amount than dextrose; in the final stage the quantities approximate but do not become equal. The following enzymes have been detected during growth: invertase, cytase, pectase, amylase, oxidase, catalase, maltase. The production of alcohol from the flowers has been studied, and a 60 per cent. yield obtained.

Fermentation studies have included the investigation of the acetic fermentation of mahua syrup, with a view to increasing the yield. To isolate calcium acetate, the fermented liquor was neutralised with calcium carbonate, but the organism did not resist a concentration of more than 2 per cent., and the calcium acetate solution could not be evaporated economically.

A flannel-like pellicle was observed when *Mycoderma aceti* was grown on a medium containing custard apple juice; its formation does not occur when other media, such as cane sugar or glucose, are used, and appears to be dependent upon the presence of pectose.

The problem of isolating a pure lactic acid bacillus, for the commercial preparation of the acid, has proved complicated owing to the vitality of sporing organisms in India, but some success has been achieved.

Good progress has been made in obtaining the dye from red sanders wood in a powdered form convenient for use, and actual dyeing trials have given encouraging results. Experiments have been made in the extraction of yellow colouring matter from *Butea frondosa* flowers, and annatto from the seeds of *Bixa orellana*.

Much work has been done on the recovery of lac from stick lac by solvents. The use of butyl alcohol as a solvent instead of ordinary alcohol appears to offer no advantages. A variety of lac with a very low melting point was prepared, which could be admixed in any proportion with ordinary lac to obtain products of varying plasticity and melting point. Successful trials were made of this material as a basis for felting cheap fibres.

The experimental soap plant of the Mysore Government has been transferred to a new factory at Bangalore where work was commenced in February, 1918. Methods of soap analysis and production are being studied.

As a result of research work on the production of glue and gelatin from bones and sinews, a large scale plant is being erected for this purpose near Bombay.

A considerable number of forest products have been investigated, and in particular samples of bark, twigs and wood from certain trees suitable for the growth of lac have been examined together with their associated gums.

Research on activated sludge has been carried out since November, 1917. At a small experimental plant for dealing with sewage erected outside the Applied Chemistry Department, data have been obtained for the construction of the larger installation at Sakchi and also valuable information concerning the character of the sludge under different conditions from the point of view of its use as a fertiliser.

Other investigations included: The determination of the solubilities of potassium and sodium carbonates in presence of each other with a view to the working up of naturally occurring salts; experiments on the refining and bleaching of native bees' wax for the Government of Mysore; a preliminary investigation of the cause of deterioration of paper, for the Imperial Librarian; and the examination of various mineral products.

Department of General and Organic Chemistry.

A. *Pure chemistry.* V. K. Bhagvat has completed a series of experiments, started in 1912, which show that the esters of strong acids such as oxalic and pyruvic undergo alcoholysis in the absence of a catalyser much more readily than the esters of feeble acids.

In a study of the action of alkalis on the isomeric phenyltribromopropionic acids and their esters, P. Ramaswamy Iyer has shown that the ααβ acid loses hydrogen bromide more readily than the αββ acid and that the two acids yield different amounts

of the stereoisomeric dibromo-cinnamic acids. The results of a research on the determination of vapour pressures of concentrated solutions of alkalis and salts and of acetone, by G. R. Paranjpe, have been published in the Institute Journal (vol. 2, part V.). Preliminary experiments by the same author on the occlusion of gases by quartz at low temperatures indicate that at the temperature of liquid air, oxygen and nitrogen are occluded but that hydrogen is not.

B. Technical work. Samples of sandalwood oil have been regularly analysed for the Mysore Government; and samples of wood from the Coimbatore District, sent by the Madras Forest Department, have been distilled, one sample yielding 8 per cent. of oil. A method of refining the dark coloured oil has yielded a product of excellent colour and good quality; 1800 lb. of oil has been distilled.

The chemical examination of the oleoresins from *Dipterocarpus indicus* and from *Hardwickia pinnata* has been completed (Instit. Jour., vol. 2, parts III. and IV.), and samples tested therapeutically in the Campbell Hospital, Calcutta, show encouraging results.

The production of thymol from Ajwan seed has been studied from the point of view of simplifying the process and of obtaining a colourless product equal to that previously manufactured in Germany. The experiments led to successful results, about 1 cwt. of colourless thymol crystals being obtained and sold at about 30*s.* 8*d.* per lb. Manufacture by this process has been started by Lakhani at Sind.

A small quantity of cardamom seed oil prepared and sent to London has been reported as of excellent quality, and 56 lb. has been ordered.

A report on wood distillation has been submitted to the Indian Munitions Board. Trials are being continued with an electrically-heated retort holding 100 lb. of wood.

Methods of manufacturing high-grade glycerin have been reported upon, and experiments have been made on the castor seed lipase method of production. A pale yellow crude glycerin containing 37 per cent. of glycerol and 1·15 per cent. total solids has been obtained.

Experiments have been made on electrolytic and quick chemical methods of manufacture. Electrolytic methods are not suitable for India.

Investigations undertaken at the request of the Munitions Board to determine the comparative results of refrigeration and of scrubbing at 35° C. the gases produced during the distillation of acetone, showed that refrigeration was not necessary, as at 35° an 85 per cent. recovery of the acetone vapour can be effected by means of a simple scrubber.

Experiments on the manufacture of straw boards from lantana and bamboo fibres showed that with lantana alone the boards are too brittle. The common bamboo yields good quality boards, and those obtained from a mixture of the two fibres are of fairly good quality. An experimental factory has already been started.

Excellent emery wheels have been made from Mysore corundum in a matrix of magnesium oxychloride. Investigations on the concentration of chrome iron ore and on the elimination of iron from Mysore pyrites have so far not given satisfactory results. A qualitative method for detecting the drug ganja has been devised. Benzene and toluene have been isolated from the oil known as "hydrocarbon" (Instit. Jour. vol. 2, part VI.).

In addition to the work recorded above medicinal preparations have been made for the Madras Government Medical Stores, many analyses and assays have been carried out, and reports issued on a variety of subjects. (See also this J., 1918, 106 R, 193 R).

NEWS FROM THE SECTIONS.

NEWCASTLE.

The Newcastle Section held its December meeting on the 18th. Prof. P. P. Bedson was in the chair.

After a vote of thanks had been accorded to Dr. Budde for allowing the members of the Section to visit the Hendon Paper Works, Sunderland, it was announced that a series of lectures had been arranged for February 19 and 26, March 5, 12, and 19, by Dr. J. W. Mellor, on "Refractory Materials."

A paper was then read by Mr. D. W. Jones on "Notes on the Wet Extraction of Copper." In former days the residue from pyrites burning was usually smelted in a blast furnace in order to recover the copper which it contained (4 per cent.). A Mr. Henderson, however, introduced the idea of roasting the cinders with salt, subsequently extracting the copper by leaching with water, and precipitating it with scrap iron. By this method much of the silver and gold could also be removed in a payable form by precipitation with an iodide. The "grist" or grinding of the cinders is of importance for ensuring proper percolation. Adequate control of the unburnt sulphur in the cinders repaid any amount of trouble; a good figure to work to was 4·5 per cent. sulphur. The usual hand-rabbled type of roasting furnace was described, and also the more modern mechanical furnaces, such as the Wedge, MacDougall, and Ramen-Beskow, these latter showing a considerable saving in fuel.

In describing the extraction of the gold, the author showed how important a part chemical control played in obtaining good recovery. He then referred to the large amounts of sodium, zinc, and iron salts which were wasted in the effluent, and to the attempts made to recover them.

In replying to the discussion, Mr. Jones said that selenium was entirely volatilised in the calcination, but in leaching, without previous calcination, it found its way into the copper. The copper precipitate produced generally contained about 78 per cent. of metal, and the arsenic precipitated with the copper was easily removed in the smelting. In the freshly burnt material the sulphur in the cinders existed as sulphide, but, after weathering, as sulphate. A preliminary roasting would be beneficial, but not profitable. The method of removing arsenic by partially neutralising the leach liquors with alkali was not in use now. He did not think that brass ash tailings could be profitably treated by this method. The quantity of cinders treated by Germany and this country would be about two million tons 18 years ago; he could not give later figures. The permissible amount of copper in the treated and de-copperised ore would be from 0 to 0·25 or even 0·4 per cent., the presence of copper in iron or steel being now regarded with favour. Nitre cake was helpful from a chemical, but not from a mechanical point of view.

YORKSHIRE.

At the third meeting of the session, held at Leeds, on December 16, Dr. Dufton gave a paper on "Limits of Separation by Fractional Distillation: A New Still Head." The paper, which is not intended for present publication, was replete with details and records of experimental results. The characteristic feature of the new still head is that it is so constructed that there is an annular space between the outer and inner tubes, with a spiral wire round the inner tube, serving the double purpose of holding it in position and providing a pathway for the descending liquor, which does not mix with the ascending vapours. In his general observations, Dr. Dufton said that chemists of the

past had been rather obsessed by the gigantic size of the commercial still, and had given up as hopeless the problem of making a perfect still. In other words, they had been content with a very modest sort of separation when, if they had had a little more confidence, and had given more attention to the efficiency of their apparatus, they might have produced pure products straight away. It had been thought that the separation of a chemically-pure benzene from a mixture of benzene and toluene was quite a hopeless task, but really it was not so; and at the close of his address the author gave a demonstration of the direct separation by distillation of pure benzene from a mixture of benzene and toluene.

In replying to a vote of thanks, Dr. Dufton said he wished to suggest that it might be much cheaper in commercial practice to build the still head on the conical system with condensation all the way up. He wanted to see a commercial still head which would yield benzol, toluol and xylol in such a way that they could be run off at different taps, and he was convinced that the scientific plan was to cool all the way up.

A short note was submitted by Mr. C. A. King on a piece of apparatus devised for the continuous testing of gases. A current of gas is led upwards through a small absorption chamber having projections on the inner walls, to effect more efficient contact with a solution of a suitable indicator which is caused to trickle slowly down the chamber. The indicator solution flows into and out of the absorption chamber through "U" shaped tubes, and forms liquid lutes against the pressure of gas in the apparatus. The outlet tube also acts as an observation tube, in which the colour of the indicator after contact with the gas is noted, and thereby the presence or absence of traces of ammonia in the gas can be immediately observed. The use of a similar form of apparatus is suggested for the detection of other constituents in gases, though obviously only where a colorimetric test may be applied.

MEETINGS OF OTHER SOCIETIES.

SOCIETY OF GLASS TECHNOLOGY.

The 21st meeting of the Society was held in the University of Sheffield on December 18. Mr. W. F. J. Wood, the president, was in the chair.

A paper was read by Mr. S. English on "An Apparatus for the Accurate Calibration of Burette Tubes." The method employed is based on that for the pipette (this J., 1918, 718 A), since it involves the use of a standardised pipette of precisely known volume and time of drainage. Both the burette and the standard pipette into which it drains are filled with water, and in order to calibrate under the same conditions as obtain in ordinary use, water is placed above the mercury level in the burette. This meniscus is viewed through a telescope attached to a cathetometer and a needle is made to produce a mark on the burette precisely at the level of the meniscus. The author stated that a burette could be calibrated in five minutes, and the accuracy was far greater than was usually observed in calibrating these instruments.

Dr. Turner then gave an address on "Bottle Glass and Glass Bottle Manufacture." In regard to quality he pointed out that it was useless to produce a bottle if the glass of which it was made was unsuitable for contact with the material it was intended to hold. Medical bottles in particular should be subjected to tests in order to ascertain that they conformed to a certain standard. One test was suggested in which solutions of the alkaloids and mercury solutions were kept in contact with the bottle for 24 hours and the absence or production of a sediment noted. The results of heating a number of different types of bottle in contact with water and steam under pressure were also described and tabulated, and emphasis was laid on the necessity of avoiding excessive use of soda ash in melts. In the case of bottles made from sand, soda ash, and lime spar, it was pointed out that lime spar should not fall below 7 to 8 per cent. of the batch mixture, otherwise the glass was acted on by water to a marked extent.

The lecturer also dealt with the problem of workability, both from the point of view of hand working and machine working. The effects of different constituents present in bottle glass were discussed and described, and the importance of arranging a batch so that the resulting glass should set quickly was emphasised, if production at a rapid rate were desired. The limits of workability for glasses containing sand and soda with either lime, magnesia, or alumina were set out.

WEST OF SCOTLAND IRON AND STEEL INSTITUTE.

Mr. Cosmo Johns read a paper entitled "The Solid and Liquid States of Steel" at the third meeting of the session, held on December 20 last, in Glasgow. The lecturer, having described the surface phenomena of liquid steel as it flows from the launder of an open hearth furnace, proceeded to point out that the laws governing surface tension applied to the samples of steel taken from the bath of the furnace, and showed that the differences in surface tension observed were governed by the amount of occluded gases present. He then emphasised the necessity for studying the heating curves of a quenched steel, explained the effect of uniform as contrasted with non-uniform pressure in depressing transformation points, and, finally, expounded the modern view which postulates the actual fusion of a small portion of any solid (with steel as a striking example) when it undergoes deformation.

INSTITUTE OF CHEMISTRY.

At a meeting of the Council held on December 20, 1918, 3 Students were admitted, and 23 new Associates and 6 new Fellows were elected.

Amongst other business the Council decided to address a circular letter to Local Government authorities recommending, in view of the prevailing economic conditions, a revision of the terms of the appointments of Public Analysts and of Official Agricultural Analysts. It was also decided that a meeting of Public Analysts should be held at the Institute to consider their position in relation to the Committee of the Local Government Board, which has now under consideration the question of the superannuation of Local Government officers.

The meeting discussed preliminary arrangements with regard to the election of the new Council. The following officers and members of the Council retire at the next annual general meeting (March 3, 1919):—Vice-presidents: Mr. H. Ballantyne and Dr. A. Harden. Members of Council: Mr. C. O. Bannister, Mr. H. C. H. Candy, Prof. G. G. Henderson, Prof. P. H. Kirkaldy, Dr. A. Lauder, Prof. G. T. Morgan, Mr. D. Northall-Laurie, Mr. G. Stubbs, and Mr. T. Tickle. The new method for the election of the Council, which is now under consideration, will not come into operation until 1920 owing to the circumstance that it must first be incorporated in the by-laws and approved by the Privy Council.

NEWS AND NOTES

CANADA.

Lyons Fair.—The Minister of Trade and Commerce of the Dominion of Canada has applied for thirty booths at the Lyons Fair, which will be opened on March 1, 1919, and continue for two weeks. A few of the booths will be used for a general Government exhibit of agriculture, forestry and fisheries, minerals and metals, but most of them will be placed at the disposal of the Canadian Manufacturers' Association for allotment to manufacturers for a display of samples and catalogues or photographs of articles which will be available for exportation to France.

Munition Workers as Miners.—The Government has sent out notices to mine managers in Northern Ontario asking them to absorb as many as possible of the men released from the munition plants. During recent months the mines of Northern Ontario have been worked with a deficiency in numbers of about ten per cent., but with the present prospect of a surplus of labour to draw from there should not only be an increased output but the net earnings should also grow.

Removal of Excise on Industrial Alcohol.—A recommendation from the Honorary Advisory Council for Scientific and Industrial Research has been sent to the Dominion Government that the excise on alcohol for industrial purposes should be taken off, and that the Government should buy from the distillers all the alcohol to be used in the industry. It is suggested that the Government should then re-sell this alcohol, at a slight advance, to every firm using alcohol for industrial purposes, and that any firm using ethyl alcohol for industrial purposes should be licensed to that end, a monthly report being made to the Government of the amount consumed. It was also recommended that ethyl alcohol should be allowed duty free to hospitals and university and college laboratories for teaching and research purposes.

Research Institute for Canada.—The Dominion Government has been asked to make a grant of $700,000 towards the erection of a central research institute, to be allocated as follows: $500,000 for the building; $100,000 for apparatus; $100,000 for salaries. It will probably be located at Ottawa. This is a further development of the idea of assisting industrial research in Canada by the formation of Trade Guilds. As planned at present, each Trade Guild will pay the salaries of its own workers, and the Dominion Government will supply the facilities for carrying on the work of research.

Anniversary Meeting of the Royal Canadian Institute.—On the occasion of the seventy-first anniversary of the founding of the Royal Canadian Institute, held in Toronto on November 23, 1918, Dr. W. S. Stratton, Director of the United States Bureau of Standards, gave an address on the work of the Bureau, which is in reality an industrial research institution, organised under the general departments of Chemistry, Physics and Electricity. Dr. Stratton's address was designed to stimulate the faith of industrial research workers in the value of their work.

Organisation of Canadian Chemists.—The work of the Committee appointed at the Convention of Canadian Chemists held in Ottawa last May has met with a favourable reception. The chemists of every province in Canada are represented on this committee, and their general aim is to obtain legislation from the Dominion Government recognising the professional status of industrial and academic chemists. The feeling is that this will greatly benefit the chemical profession, and at the same time place qualified men in charge of all chemical work. In Canada, as elsewhere, the public has not yet learned to distinguish between the chemist who is an industrial or professional man, and the chemist who is a druggist or pharmacist.

UNITED STATES.

Award of the John Scott Legacy Medal and Premium.—The City of Philadelphia, acting on the recommendation of the Franklin Institute, recently awarded the John Scott Legacy Medal and Premium to E. J. Sweetland, of Upper Montclair, N.J., for the Sweetland Filter Press. This invention is to provide a self-dumping filter press, which will reduce to a minimum the labour involved in discharging the solid residue left in the press after filtration, and also the labour of cleaning the press by hand.

Physiological Action of Mustard Gas.—A research by Dr. G. H. A. Clowes has yielded results indicating the action of mustard gas on the live cell. Substances soluble only in the aqueous phase cannot penetrate the cell, but mustard gas is fat or lipoid soluble and so enters the cell before it is hydrolysed. Within the cell hydrolysis takes place, forming hydrochloric acid, and it is the destruction of large numbers of cells by this acid which produces the characteristic mustard gas burn. The experiments were made with marine organisms.

Candelilla Wax.—In the continued search for sources of potash it has been found that the candelilla plant after wax extraction may be burned to an ash which yields a high percentage of potash. In fact the candelilla contains more potash than any other plant thus far examined. It grows in great quantities in Mexico and Texas and has lately attracted much attention because of the excellent wax obtained from it.

The Zinc Industry.—A series of instructive pamphlets has been prepared by the New Jersey Zinc Co. for free distribution dealing with the composition and uses of zinc dust, pigments, rolled zinc, spelter and other zinc products. The zinc industry is faced with at least two important problems: greater efficiency in roasting the ore and new uses for zinc. Work begun on these lines just prior to the war will undoubtedly be resumed again soon.

Artificial Leather.—One of the more promising artificial leathers, still in the experimental stage, makes use of cotton batting treated with a special rubber solution. One of the fundamental advantages lies in the absence of direction of weave or pattern in this base material, the interloaded fibres imparting strength and giving a foundation for the finished leather not unlike the texture of animal tissue.

Saccharin as a Substitute for Sugar.—The harmlessness of the use of saccharin as a flavouring agent and its worthlessness as a provider of energy are facts which have been fully established on many occasions, but the question of its stimulatory action on the oxidation processes in the body has hitherto received little attention. In this connexion W. E. Burge has communicated to *Science* (Nov. 29, 1918) the results of experiments conducted by him to find out if the ingestion of saccharin produces an increase in catalase (the enzyme which liberates oxygen from hydrogen peroxide, an action which Burge and Neill found to increase when sugar and other foods are ingested), and hence an increase in oxidation in the body. The main result was that saccharin produces a much greater increase than sugar, and the conclusion is therefore drawn that saccharin is a positively helpful element of diet, particularly in a disease such as diabetes where the principal trouble is defective oxidation. The experiments were performed on dogs.

SOUTH AFRICA.

Facilities for Industrial Development.—The recent expansion of industrial activities in the Union of South Africa has induced certain municipalities and similar public bodies to offer specially favourable terms to manufacturers in regard to water and power rates as well as sites for the establishment of industries. The Trade Commissioner for the Union has been notified that the Pietermaritzburg Corporation is prepared to offer suitable sites on very reasonable terms, and to submit plans with additional information as to supply of labour, raw materials, railway communications, etc. The water rate varies from 1*s*. 6*d*. per 1000 galls. for a monthly consumption of 250,000 galls. to 9*d*. per gal. up to 12,000,000 galls. Electricity can be supplied on a graduated basis of 3*d*. to 0·84*d*. per unit per month and for industries of a kind not already established a reduction of $33\frac{1}{3}$ per cent. will be granted.

GENERAL.

Industrial Fatigue Research Board.—A Research Board has been appointed by the Department of Scientific and Industrial Research and the Medical Research Committee jointly to consider and investigate the relations of hours of labour and of other conditions of employment, including methods of work, to the production of fatigue, having regard both to industrial efficiency and to the preservation of health among the workers. The chairman of the Board is Prof. C. S. Sherrington, of Oxford University, and the secretary, Mr. D. R. Wilson (Industrial Research Board, 15, Great George Street, Westminster, S.W. 1).

Labour Shortage in the Heavy Chemical Industry.—The secretary of the Chemical Trade Industrial Council and of the Chemical Employers' Federation states that owing to the imminent exhaustion of stores of alkalis and acids and to the lack of labour necessary to replenish them, several industries employing a total of 200,000 workers will soon be seriously affected. This condition of affairs is attributable to the omission of the heavy chemical trade from the list of pivotal industries, although several industries which have been so scheduled are essentially dependent upon chemical products. Two companies which together produced about 75 per cent. of the alkali consumed in this country have stocks in hand sufficient to meet demands for only nine days. Of the 6000 men allocated for release from the forces to the quarrying industry, but 1750 have been allotted to the lime quarries, scheduled as pivotal, and none has returned to work in spite of the fact that lists of these men were submitted to the War Office more than a month ago.—(*The Times, Dec.* 28, 1918.)

The Library of the Chemical Society.—With a view to meeting the growing demand for technical literature, the Council of the Chemical Society decided early in 1917, to increase the scope of the library by a more liberal provision of suitable technical works and journals. It was also thought that by placing the existing library of 23,000 volumes and the proposed extension at the disposal of members of other societies and associations, they might relieve themselves of the necessity of collecting and maintaining the literature relating to their special subjects, and assist in the formation of a representative Library of Chemical Literature, such as would be difficult to obtain by individual effort. A conference of representatives of societies and associations connected with chemical science and industry was held to consider the means by which other societies, etc., might co-operate in this extension, and financial assistance was subsequently offered by the following:—Association of British Chemical Manufacturers; Biochemical Society; Faraday Society; Institute of Chemistry; Society of Chemical Industry; Society of Dyers and Colourists; and Society of Public Analysts. Members of these contributing societies, etc., will be permitted to consult the library and borrow books from January 1, 1919. The hours during which the library will be open are as follows:—Mondays, Wednesdays, and Thursdays, from 10 A.M. to 6 P.M., Tuesdays and Fridays, from 10 A.M. to 9 P.M., Saturdays, from 10 A.M. to 5 P.M.

Indian Mining Industry.—The Annual Report of the Chief Inspector of Mines for 1917 shows that there has been a considerable shortage of labour, especially in coal mines, although the number of hands employed has increased 7 per cent. above that of the previous year. There are 211,800 persons now engaged. The coal production reached a record figure of 17,326,000 tons of which nearly 15,000,000 was actually despatched. The mines of Bengal, Bihad and Orissa account for 95 per cent. of the production. The output per person is extremely low when compared with England:—(*a*) per person below ground 182 tons, (*b*) per person above and below ground 113 tons; the corresponding English figures for 1916 were 323 and 251 tons respectively. With sufficient supply of labour it is estimated that the present workings could yield an increased production of 50 per cent. The mica production of 35,900 cwts. is practically the same as in 1916, but that of manganese decreased from 568,000 to 497,000 tons. To meet the war demand for tungsten, the wolfram output has been substantially increased, the total production amounting to 79,300 cwts. The systems of mining wolfram at present in use are wasteful, but there is a tendency to introduce more modern methods and plants, such as pneumatic drills and hydro-electric power plants. A magnetic separator has been working successfully at Tavoy (Burma). The output of gems (rubies and sapphires) shows a slight falling off, and the markets have been somewhat erratic. 22,900 ounces of gold has been produced. Of the other minerals mentioned in the report, the copper output of 20,000 tons (compared with 2670 tons in 1916) is noteworthy; also the first recorded production in India of bismuth, which is being won from a wolfram mine in Tavoy.—(*Bd. of Trade J., Dec.* 19, 1918.)

Drug Plant Production in India.—The price of jalap (*Ipomoea purga*) has risen considerably during the war, the local market price being now about 1*s*. $4\frac{1}{2}$*d*. per lb. It has been grown for many years on the Government's cinchona plantations in the Nilgiri Hills, and an attempt has been made to increase the stock in the botanic gardens with fair results. An acre of jalap yields about 5000 lb. of green tubers, which is equivalent to 1000 lb. of powder.

Experiments are being made in the same plantations in the cultivation of a number of drug plants, successful results having been obtained with foxglove, henbane, common mint, fennel and rosemary, but not with belladonna, aconite and ipecacuanha. Experiments with Indian tobacco and *Chenopodium anthelminticum* are in progress.—(*U.S. Com. Rep., Nov.* 16, 1918.)

Alsace-Lorraine and the Iron-ore Output.—The total production of iron-ore in the German customs area amounted to approximately 34 million tons, of which 20 million tons was obtained in Alsace-Lorraine alone; 5·2 million tons was produced in Prussia. The output in Luxemburg, which has hitherto belonged to the customs area, was 6·5 millions. If the latter achieves independence and Germany loses Alsace-Lorraine, the total annual production of iron ore in Germany will fall to about 7 million tons, or a fifth of the former quantity. France, on the other hand, was already producing

more iron than could be used in her foundries, and about 4 million tons of her total output of 22 million tons was exported to Germany. Even before the war and with the supply from Alsace-Lorraine, the German output did not cover the requirements of her blast-furnaces, but 14 million tons had to be imported, of which 4·6 million tons came from Sweden, 3·8 million tons from France, and 3·6 million tons from Spain. German exports of iron ore only amounted to 2·6 million tons, of which 1·8 million tons went to Belgium. The supply from Spain is likely to be uncertain, partly owing to increased home consumption, and partly to the Entente Powers having secured a considerable proportion of the Spanish output.—(*Neue Freie Presse, Nov.* 3, 1918.)

Alsace-Lorraine and the Coal Problem.—Before the war France suffered from a coal shortage, and this shortage will be much more serious after the war owing to the destruction of mines and machinery by the Germans. The latter will be compelled to hand over to France the amount of coal of which they have deprived her, but however just this restitution may be, it will not solve the existing problem of increasing the coal supply for industrial purposes. Before the war, coal production in France amounted to 40 million tons, and the consumption was 63 million tons, leaving a deficit of 23 million tons. After the war the mere fact of the restoration of Alsace-Lorraine will increase the deficit to 31 million tons, because these provinces produce only 4 million tons and consume 12 million tons.—(*Europe Nouvelle, Nov.* 23, 1918.)

Ore Discoveries in Sweden in 1917.—During 1917 there were registered 1,042 claims for newly discovered minerals. The majority related to iron-ore, and of these 139 were in the Kopparberg district; 195 related to pyrites, of which seventy-five were in the Orebro district; 184 to manganese (chiefly in the Norrbotten district), and 126 to copper (thirty of these claims were in the Kopparberg district, twenty in the Kalmar district, and twenty in the Orebro district).—(*Aftonbladet, Nov.* 1, 1918.)

Yield of Venezuelan and Bolivian Mines in 1917.—During 1917 the yield of the Venezuelan mines was as follows:—Gold, 30,809 oz.; copper ores, 42,721 tons; petroleum, 54,072 tons; coal, 20,165 tons. The effect of the war on the Bolivian ore output is shown by the following figures:—

Ore	1916 Tons	1917 Tons	Tons
Tin	34,523	45,418	+10,895
Wolfram	2,371	2,804	+433
Antimony	25,845	21,287	−4,558
Bismuth	487	492	+5

(*Export, Sept.* 24, 1918.)

Recovery of Animal Fats with Benzine.—The greatly diminished importation of fat into Sweden has induced research into the best way of recovering fatty products from dead animals A company has been formed to exploit a process of boiling out carcases with benzine instead of with water. Collecting depôts will be established where carcases can be flayed and partly cut up preparatory to dispatch to the main factory, where the material will be placed in large, horizontal, enclosed steel vessels of 2½ tons capacity, and extracted with benzine. The residual matter will be dried and ground to a meal containing 60 per cent. protein, of which 80 per cent. is soluble, which is said to form a good cattle food when mixed with molasses. Fish offal can be treated similarly, but, as this material contains 75 per cent. of water, time and space are saved by drying the material before treatment.—(*Teknisk Tidskrift, Oct.* 19, 1918.)

Slate in the U.S.A. in 1917.—The domestic slates sold in the United States amounted to 70,366,700 sq. ft. of roofing slates of a value of £700,000, 5,478,151 sq. ft. of mill stock of a value of £255,000 (used for structural and sanitary purposes), and slates used for other purposes of a value of £200,000. This shows a decrease of over 40 per cent. in the quantity of roofing slates since 1912, but the mill stock remained fairly constant and variegated coloured slates showed a considerable increase.

The average selling price in different States varied considerably, though the general demand was poor except in Vermont and New York. The prices have been steadied in some districts by the establishment of selling companies each representing numerous producers. The Marne slates are specially suitable for electrical work and the demand for this purpose has been good.

Slates for blackboards decreased nearly 17 per cent. in quantity, but increased 2 per cent. in value. School slates decreased 12 per cent. in quantity, and 7 per cent. in value. The substitution of slates for paper in the American schools is under consideration. There has been a growing demand for black slate tombstones, particularly in Massachusetts. Three firms have erected plants for the manufacture of roofing material from ground slate, which is also used for coating asphalt shingles and in finishing linoleum and wall-coatings. The suggestion is made that the waste slate should be sawn into blocks of uniform size for building foundations and partition walls. The selling companies contemplate avoiding unnecessary competition, standardising the output, reducing the costs of marketing, and, above all, conducting a much-needed publicity campaign, as hitherto roofing slates have scarcely been advertised at all in the trade, technical and popular journals.

The bulk of the slate exported from the United States in 1917 went to Canada, but Mexico, South Africa and Australia received noteworthy amounts. Slate exported for purposes other than roofing consisted chiefly of electrical slate, structural slate, blackboards, school slates, slabs and billiard tables. It went chiefly to Canada (16%), Central and South America (47%), West Indies, Cuba, Denmark, Russia and India (about 8% each), the total value of these exports in 1917 being £40,000. The school slates amounted to two-thirds of the total slate (other than for roofing) exported in 1917.—(*U.S. Geol. Surv., July*, 1918.)

The Nettle as a Source of Textile Fibre.—The common stinging-nettle is likely to become an important factor in agriculture and in the development of the textile industry. Among the many fibrous plants experimented with, the nettle alone has fulfilled all the conditions of a satisfactory source of textile fibre.

Investigations and practical tests, made in 1916 at Brünn and Reichenberg, confirm the hopes raised concerning the possibilities to be realised in nettle fibre. There exists now in Germany a "Nettle Cultivation Company." The price of 10 marks per 100 kilo. of air-dried nettle stalks ensures sufficient profit to the growers, while the cost of preparation is not high. In 1915, 1·3 million kilo. of this material was collected in Germany, and this was increased to 2·7 million kilo. in 1916. From the standpoint of the factory it is affirmed that goods woven from this fibre are, for most uses, equal to cotton goods. Hence for middle Europe at least a large and increasing use of nettle fibre seems assured.—(*Technische Blätter*, Part 3/4, 1918.)

Synthetic Mineral Oil.—It is reported that the Baden Aniline and Soda factory has taken the initial steps in the production of synthetic mineral oil, and has succeeded in obtaining liquid or easily liquefiable hydrocarbons synthetically.—(*Pester Lloyd, Oct.* 17, 1918.)

LEGAL INTELLIGENCE.

SALE OF CHEMICALS (CONTRACT) DISPUTES. *Gibson and Co.* v. *Biggs, Gwyer and Co.*

In the King's Bench Division, on December 16, Justices Lawrence and Shearman heard the appeal of the defendants from a judgment of Judge Mellor in the Manchester County Court, on April 23 last, in favour of the plaintiffs for a balance of £35 9*s.* due to them for the supply of light magnesia, soda ash, and other chemicals. The ground of the appeal was that the case was one coming within the Statute of Frauds, and that there was no evidence before the judge on which he could find that there was any undertaking by the defendants to pay the money claimed, which was, in fact, owed by somebody else. There were several items in the claim which were admitted by the appellants and for which they had paid money into Court. The appeal was allowed, with costs.

British and French Manufacturing Co. v. *Biggs, Gwyer and Co.*

Before the same Court on the same day, the British and French Manufacturing Co. appealed against a judgment given by Judge Mellor at Manchester in favour of the defendants in respect of a claim for the supply of magnesium sulphate, valued at about £44.

Mr. Justice Lawrence, in giving judgment, said that the Epsom salts were sold by the plaintiffs to the defendants for shipment to Alexandria, and by a term of the contract they were to be delivered f.o.r. Manchester. They were delivered by October 9. At Hull, where the goods were sent, samples were taken, and it transpired that the salts were not of the stipulated B.P. quality, but of a quality used for commercial purposes and totally inconsistent with the contract. Upon this analysis the defendants rejected the goods. The judge had held that the rejection was not too late and that it was within reasonable time. The appellants maintained that the buyers could not rely on rejection as the goods had been allowed to go on ship. He thought there must be a reasonable time for the examination of goods to ascertain whether or not they conformed to the contract, and the defendants could not reject until they had received the results of the analysis. It could not be truly said that there was any act on the part of the buyers that was intended to be inconsistent with the ownership, or that was intended to waive the right to reject which was incident to the contract. Mr. Justice Shearman concurring, the appeal was dismissed, with costs.

SODA ASH CONTRACT ARBITRATION. *Perry, Mills and Co.* v. *Adamson, Gilfillan and Co.*

On December 17, in the King's Bench Division, before Justices Lawrence and Shearman, a motion was heard on behalf of Perry, Mills and Co., London, to set aside an award of an umpire in an arbitration that took place between them and Messrs. Adamson, Gilfillan and Co., Ltd., also of London, arising out of contracts of June, July and August, 1917, for the sale by appellants of quantities of heavy soda ash.

Counsel for the sellers said there had been three awards in three arbitrations, and the ground for the motion to set them aside was that the umpire had been guilty of misconduct in law in the conduct of the arbitration. The three contracts were in identical terms and the sellers duly made delivery of the goods, but later received a complaint that analysis showed only 40 per cent. quality. The two arbitrators appointed failed to agree and the umpire's award was adverse to the sellers.

In the course of his judgment, Mr. Justice Lawrence said the motion to set aside was put forward on three grounds, which were all based on the principle that there was misconduct by the umpire in the hearing of the arbitration. It was quite true that there might be what was called misconduct by an umpire or an arbitrator in refusing a special case, but it was only so where the special case was asked for in a reasonable and proper way, and where it was made clear what the point was for which the special case was required. Here it was said there was no evidence that the samples produced were samples of the goods as delivered, but it was clear upon the evidence that no such point was taken before the umpire when the samples were produced, or when they were sent to be analysed. This was done without objection at the time, and the present ground of complaint was that when the analysis came in the parties were not called upon to argue and the analyst was not called to be cross-examined. The sending of the samples to the analyst was acquiesced in, and it was only after the award that the objection was taken. The application failed and must be dismissed with costs. Mr. Justice Shearman agreed.

NITRATE CARGO DISPUTES. *Aktieselskabet Yuba* v. *Dansk Svovlsyre Superphosphat Fabrik (Copenhagen). Aktieselskabet Olivebank* v. *The Same, and Aktieselskabet Geysir* v. *The Same.*

The above three separate actions, involving different contracts, were heard by Mr. Justice Bailhache in the Commercial Court of the King's Bench Division on December 10 and 12, 1918. The plaintiffs were Norwegian sailing ship companies and the total sum involved was between £20,000 and £30,000. The shipowners claimed that they had a right to discharge the cargoes of nitrate in the United Kingdom on the terms of being paid freight and damages for detention. The defendant company maintained it was entitled to have the cargoes carried on to Denmark, or alternatively, it was entitled to treat the adventure as frustrated, and it based a counter-claim on this view. The difficulty arose through the action of the British Government, in 1915 and 1916, in stopping all nitrate cargoes which arrived in the United Kingdom, and refusing permission to proceed to Danish ports. There was a clause in the contracts stipulating that the contracts were conditional on the British Government granting permission to the ships to proceed. At that time there was no permission to re-export, and there was a rationing agreement between the British and Danish Governments whereby the former allowed a certain amount of nitrate to go through, but the amount agreed upon for 1916 (33,000 tons) was already exceeded when the ships in question were detained.

In the case of the *Yuba*, his Lordship said the shipowners were relieved from completing the voyage, but that did not entitle them to require payment of freight. There was no obligation on the consignees to name any other port at which they were willing to take discharge of the cargo. Therefore the shipowners could not recover. The restraint amounted to a frustration of the adventure, and therefore the defendant company could not succeed in its counter-claim for damages for breach of contract. A similar judgment was given in the case of the *Geysir*. In regard to the ship *Springbank*, there was no port of destination mentioned. By the time she arrived at Falmouth the rationing agreement was in full force. When ordering her to proceed to Aalborg the consignees knew that it was impossible for her to go there. The defendant company could have nominated a port of destination in the United Kingdom, but did not do so. Therefore the plaintiff company suc-

ceeded in the claim for freight and damages for detention, and the defendant company failed on the counter-claim. Judgment was therefore given for the defendant company in the first two cases, and for the plaintiff company in the third case.

REPORT.

Report of the Government Chemist upon the Work of the Government Laboratory for the Year Ended March 31, 1918. With Appendices. [Cd. 9205, 2*d*.]

The number of samples examined during the year was 200,453 as compared with 258,456 in the previous year, the decrease in number being principally in the Excise and Customs samples. Work for several new Departments, including the Air Board, the Ministry of Food, and the Coal Controller, was undertaken during the year: 20,020 samples were examined in connexion with the food supply of the Expeditionary Forces, a part of this work being carried out at the various supply bases. The samples of brewing materials numbered 394, and 275 samples of finished beer from brewers' premises were examined for saccharin, saponin, etc., but nothing of a deleterious character was found to be present. A few of the non-alcoholic beers analysed contained more than 2 per cent. of proof spirit, but 5 so-called non-alcoholic wines contained from 7·0 to 17·3 per cent. of proof spirit. Of 1469 samples of beer and brewing materials examined for arsenic, 75 contained arsenic in excess of the permitted limits. Only 23 samples of imported beer were received, the importation of beer having practically ceased. Compared with previous years, there was a decrease in the number (877) of samples of naphtha examined, this naphtha being intended for use in the preparation of methylated spirit; there was an increase in the use of pure alcohol for manufacturing purposes. The other samples examined for the Customs and Excise comprised wines, tobacco, sugars, tea, coffee, cocoa, matches, medicines, etc. During the year, 1076 samples, mainly alloys, were analysed for the Air Board. The samples received from the Board of Agriculture and Fisheries numbered 1528, including 139 samples of imported condensed milk, 18 of dried milk, 14 of cream, 431 of butter, 617 of margarine, and 48 of cheese. All the samples of condensed milk were free from preservatives and the percentage of fat ranged from 6·5 to 10·9; the samples with a low fat content were consignments of evaporated milk from America. A considerable quantity of this class of milk was imported; it is generally described as "evaporated" milk, and consists of whole milk which has been evaporated to about one-half its bulk. The samples of imported butter were all genuine and free from excess of water; 251 of these samples contained boron preservative and 123 added colouring matter. The imported margarine was of satisfactory composition, but 10 of the samples contained excess of water; all the imported cheese was free from foreign fats. Amongst the samples received from the Home Office were various samples from the London police, including chocolates given to children and others under suspicious circumstances, drugs taken in connexion with the regulations limiting the use of cocaine and opium, and samples of liquors. The Ministry of Munitions submitted 41 samples for examination, including petrol substitutes, peat, fire extinguishing fluids, mainly of the chlorinated hydrocarbon type, and a so-called substitute for platinum, which proved to be an alloy of nickel, chromium, and tungsten. Samples of coal were examined for the Coal Controller, the usual determinations being made. Samples examined for the Admiralty Marshal and Treasury Solicitor numbered 396, and consisted of materials seized as Prize; the substances included thorium nitrate, pigments, polish, drugs, and tanning materials. A large variety of foods was analysed for the War Department, the number of samples being 20,020: nearly 17,000 samples were taken from contractors' deliveries in course of transit to the Expeditionary Forces. Investigations were also carried out with reference to the waxed paper containers now being used in place of tin for packing supplies to the Forces; the wax was examined as to its suitability for the purpose, and inquiry was made regarding the keeping qualities of the goods in these containers. The War Trade Department required analyses of a great variety of substances, including soaps, disinfectants, printing ink, ceramic colours and glazes, pitches, rubber solutions, paints, coal tar oils, metallic capsules, drugs, etc. A method was worked out and published (see this J., 1917, 842) for the determination of carbolic acid or phenol in disinfectants. Numerous samples of materials supplied by contractors for the public service and of materials used in the construction and maintenance of public buildings were examined for the Office of Works, London. Samples of water from public buildings, munition works, and camp sites were also analysed. The samples referred by magistrates under the Sale of Food and Drugs Acts of 1875 and 1899 numbered 102, including 81 samples of milk, 3 each of nut lard, Epsom salts, and cream of tartar, 2 each of butter, dripping, rum, sweets, and vinegar, and 1 each of whiskey and baking powder. The results of the analyses differed from those of the public analyst in 13 cases. Twenty samples, consisting of 8 fertilisers and 12 feeding stuffs, were submitted under the Fertilisers and Feeding Stuffs Act; the fertilisers comprised phosphates, guano, shoddy, and special manures: the feeding stuffs consisted of feeding meals and cakes, milling by-products, and poultry foods. Several of the feeding stuffs contained a considerable proportion of substances unsuitable for feeding purposes.

GOVERNMENT ORDERS AND NOTICES.

EXPORT PROHIBITIONS.

Further relaxations of existing export prohibitions have been announced by the Board of Trade as follows* :—

Headings transferred from one list to another.

From List A to List C:—

Burettes and their component parts; capsicum, including oleo-resin of capsicum; glue, osseine, and concentrated size (and other sizes and sizings made from glue), finings and other kinds of gelatin; hydrometers made of glass; nitrometers and their component parts; tar, vegetable; uranium, alloys of uranium and uranium ores; vanilla and vanilla pods. Chemicals :—Aluminium nitrate; cassia pods and pulp; phosphorus compounds not otherwise prohibited.—(Jan. 2.)

From List B to List C:—

Rubber (raw, waste, and reclaimed), solutions, jellies, and other preparations containing rubber. —(Dec. 26.)

Aluminium, and alloys of; aluminium powder; antimony and alloys of; antimony, sulphides and oxides of, and mixtures containing.—(Jan. 2.)

* Goods on List A are prohibited to all destinations; goods on List B to all destinations outside the British Empire; goods on List C are prohibited only to countries neighbouring enemy countries.

Altered Headings.

(A) Guanos, not including whale guano; (C) whale guano.—(Dec. 26.)

(A) Cream of tartar; (C) tartaric acid and alkaline tartrates not otherwise prohibited.—(Jan. 2.)

Export of Cutch to France.—The Director of the War Trade Department is prepared to entertain applications for licences to export limited quantities of cutch to France.

General Licences for Exports.—On and after January 9, the exportation of the following goods became permissible to all destinations, except those specified in Section C of the prohibited list:—Mixtures and preparations containing not more than 10 per cent. aniline colour, not otherwise prohibited; phenalgin; adhesives containing not more than 25 per cent. of starch, or other cereal substance, etc.

ORDERS SUSPENDED AND CANCELLED.

The Minister of Munitions has suspended until further notice:—The Copper (Sale or Purchase) Order, 1916. The Copper (Use in Manufacture) Order, 1916. The Copper (Control) Order, 1917. The Brass and Copper (Returns) Order, 1916. The Brass (Swarf and Scrap) Control Order, 1917. The Cupro-Nickel Scrap (Dealings) Order, 1917. The Spelter (Control) Order, 1917. The Spelter Control (Amendment) Order, 1918. The Lead Order, 1917, and the two Lead Control (Amendment) Orders, 1918. The Type (Metal) Returns Order, 1918. The Tin (Dealings) Orders of 1917 and 1918. The Chrome Ore Order, 1918. The Platinum Order, 1915, and the Platinum Metal Order, 1916. The Aluminium Order, 1916. The Aluminium (Returns) Order, 1917. The Aluminium (Scrap and Swarf) Order, 1917. The Refractory Materials (Maximum Prices) Order, 1918.

The Benzol and Naphtha Order, 1917. The Naphtha Order, 1917. The Tar (Coal and Water Gas) Order, 1917. The Chlorine and Chlorine Compounds Order, 1918. The Acetic Acid Order, 1917, and the Acetic Acid (Extension) Order, 1917. Until further notice, grey acetate of lime and acetone cease to be specified as war material.

The following Orders have been cancelled by the Board of Trade:—The Lighting, Heating and Power Order, 1918. The Motor Spirit (Consolidation) and Gas Restriction Orders, 1918.

The Admiralty has cancelled the Hydrogen Order of June 11, 1918. The Army Council has cancelled the Hides (Restriction of Tanning) Order, 1918.

OTHER ORDERS AND NOTICES.

The Paper (Relaxation of Restrictions) Order, 1918, Board of Trade, Dec. 18.

The Articles of Commerce (Relaxation of Restrictions) Order, 1918, Board of Trade, Dec. 21.

Paper Regulations for 1919, the Controller of Paper, Dec. 14.

The Ministry of Munitions announces that the suspension of the operation of Regulation 30a of the Defence of the Realm Act on acetic acid, grey acetate of lime, and acetone, covers in addition products associated with acetone, which have also been restricted under the Acetone Order, including methyl acetone, methyl-ethyl-ketone, and acetone oil. Trading in all of the above-mentioned articles abroad, as well as at home, is now entirely free with the exception of those cases where export licences have still to be obtained from the War Trade Department. No formalities are now necessary in regard to the import of these materials from the U.S.A.

COMPANY NEWS.

LEVINSTEIN, LTD.

Presiding at the annual meeting, held on December 23, Lord Armaghdale said that an overwhelming majority of the shareholders had approved the proposed amalgamation with British Dyes, Ltd., and that amalgamation is now practically an accomplished fact. The future success of the textile trades of this country depends largely upon the outcome of the impending struggle between the British and German dye industries. Prior to the war the Germans had acquired a control over the textile trades of all countries in the world, and had used it as one of their principal means of peaceful penetration. The danger of dependence upon Germany is now realised and all that is required is adequate financial support; on the scientific side success is certain.

During the past year the company's factory at Port Ellesmere was compelled by governmental restrictions to go on short time for over two months, thereby creating a temporary shortage of synthetic indigo; full output has since been restored, and now that the war is over large developments may be expected. The company has acquired at Ellesmere Port two options to purchase land in close proximity to its existing works. The site possesses a two-mile frontage to the Manchester Ship Canal, the land is suitable for building purposes, is near the North Wales coalfields, and generally compares favourably with the site of any chemical works in the country, and with those of the dye factories situated near the Rhine.

In addition to manufacturing an extended range of dyes, including vat dyes which were previously only manufactured in Germany, much research work has been carried on, and valuable assistance has been given in connexion with the preparation of lethal gases for the army. Had hostilities not ceased when they did, it is probable that the enemy would have been overwhelmed by a particularly deadly gas which the Gas Warfare Department had in store for him, and of which the large-scale manufacture had been successfully worked out by this company.

Owing to delay in settling with the Inland Revenue authorities, it was impossible to present any accounts, or to state the number of shares in the British Dyestuffs Corporation which would be received in exchange for their own, but both will be found entirely satisfactory when announced.

The increase in production of intermediates (over 150 in number) in 1918 was nearly 11 times greater than in 1914 (15,169,122 lb. against 1,403,490 lb.), and of finished dyes 7½ times greater. The nitric and sulphuric acids required for the former had to be made by the company; the output of these in 1918 was 22,619,363 lb., as against none in 1914. In pre-war days, the average profit was equal to £1 per cent. on the share capital; the overhead charges for research and for the selling organisation were unduly high owing to the small output. Had the reduction of dyes in 1914 been equal to that in 1918, the profits would have approached those made by one of the more important German firms, and provided they had been sold at the same prices as the German dyes, they would have been far more than 7 times those actually achieved. The estimated net profits on dyes during 1918, excluding intermediates, was about 6·15 times those in 1914, but they are much below those made by the Germans in this country prior to the war. The plants in Germany are for the most part intact and are more than sufficient to supply the home demand. Moreover, we have yet to erect a large amount of plant at high cost, whereas the German plants were erected at a much lower cost and have already been written off; hence the necessity for financial aid from the State.

CASTNER-KELLNER ALKALI CO., LTD.

At the Cannon Street Hotel, on December 18 last, the Rt. Hon. G. W. Balfour presided at the twenty-third ordinary general meeting of the company. Dealing first with the report and accounts, he said the figures ran curiously parallel with those for the previous year; the net profit was £2000 smaller at £261,339, and the available balance was £3000—£4000 higher owing to a larger carry-over. Accordingly, the appropriation of the latter would be the same, *viz.*, £50,000 to depreciation (making that fund now £587,500), 20 per cent. dividend for the year, leaving £48,819 to be carried forward. Although the past year has not been an easy one, practically all energies having been concentrated on war work, the results are distinctly satisfactory. Experiments in the manufacture of new chemical products have been carried out for the Government, and the large extensions of buildings and plant undertaken at its request have been proceeded with. The question of the completion of the extensions is one for negotiation with the Munitions Department, but the company's interests appeared to be adequately safeguarded. Owing to difficulties arising from the awards issued by the Committee of Production in regard to wages, the Profit Bonus system became a source of friction rather than a bond of union between the company and its employees. Hence it has been abandoned, and a new arrangement has been substituted under which additional payment is made in respect of length of service, and which results in the employees being rather better off than before. Much assistance has been received during the past year from the Chemical Employers' Federation, and it is intended to establish Works Councils on the lines of the Whitley Reports at an early date.

PEAT-COKE AND OIL SYNDICATE.

At the annual meeting held in London on December 5, Mr. J. W. Leadbeater, chairman, said that the syndicate was established to work out a process for the production of a good coke or smokeless fuel from peat, with by-product recovery. One complete gas plant had been adapted to the process, and it was intended to bring others, now under option, into operation as soon as possible. At the present time the syndicate was renting spare plant at two gas works The decolorising agent obtained as a by-product had been very favourably reported upon. The coke employed in the process, in conjunction with peat, was the very smallest gas coke, and these, with a certain binder, made an excellent but not a smokeless fuel, which was now being sold at £2 per ton at the works. No special retorts have been used up to the present, the carbonisation being effected at a low temperature.

CASSEL CYANIDE CO., LTD.

Sir George Beilby, chairman of the company, presided over the annual meeting held in Glasgow on December 11. In moving the adoption of the report, he said that during the past year the company had produced sufficient cyanide to meet all demands. During the war there had been a reduction of quite 20 per cent. in the world's consumption of cyanide for the treatment of gold ores, which was due partly to economy in use, and partly to the diminished demands from low-grade gold mines. No immediate improvement on the Rand is to be expected. In normal times, Mexico is a large buyer of cyanide, and as conditions there improve American competition becomes keener. It was further stated that during the twenty-six years of the company's existence it had held its own against German competition, and during the war it had supplied the entire requirements of the Empire and of the Allies.

BRITISH COALITE, LTD.

At the ordinary general meeting held on December 18, in London, Mr. J. W. Fisher (chairman of the company) said that they had now passed from the region of promise into that of performance, and would reap the fruit of this when the managing company, Low Temperature Carbonisation, Ltd., began to pay the agreed royalty of 1*s.* per ton upon an annual minimum of 700,000 tons of coal carbonised. The plant at Barnsley had run for a year and was turning out thoroughly good coalite, and a satisfactory yield of other substances. Owing to the badness of certain materials supplied, the output of tar had been below expectations; the company had also suffered from the scarcity and inferiority of labour. Good prices had been obtained for all products, and the coalite had fetched an average price of 40*s.* per ton at the works.

New Issues.—*The Mond Nickel Company* has issued £1,520,000 of seven per cent. non-cumulative preference shares at par, the proceeds to be used in extending the company's refining works, which when completed will be increased by 50 per cent. The prospectus states that the products manufactured comprise nickel, copper sulphate, nickel salts, and concentrates of precious metals (platinum, palladium, gold and silver), all derived from the company's mines in Ontario. It is claimed that the quantity of platinum and palladium recovered therefrom is by far the largest produced within the British Empire.

The Morgan Crucible Company has issued £500,000 six per cent. £100 redeemable debentures at 98. The issue was sponsored by the British Trade Corporation, formed under Government auspices in 1916 to help British industrial ventures after the war.

OFFICIAL TRADE INTELLIGENCE.

(From the *Board of Trade Journal* for December 26 and January 2.)

OPENINGS FOR BRITISH TRADE.

An agent at Townsville, Queensland, desires to obtain agencies for U.K. manufacturers of paper, chemists' and druggists' requirements. [Ref. No. 422.]

A firm at Montreal desires to get into touch with U.K. manufacturers of fire-clay bricks, silica bricks, crucibles and hardware. [Ref. No. 425.]

An agent at Toronto wishes to obtain agencies for U.K. manufacturers of certain kinds of paper, samples of which may be seen at the Department of Overseas Trade. [Ref. No. 430.]

An agent at Ceuta, Morocco, seeks agencies for U.K. manufacturers of paper, pharmaceutical products, paints, varnishes, sugar and preserved foods. [Ref. No. 436.]

A partner in a firm at Cape Town now in this country wishes to obtain agencies for U.K. manufacturers of enamelled ware, pottery, glass, paper, rubber, cement, paints, leather and superphosphates. [Ref. No. 442.]

Firms in the Netherlands desire to get into touch with U.K. manufacturers of rubber tyres and thermometers. [Ref. Nos. 447 and 448.]

Inquiries have been received at the British Chamber of Commerce, Milan, from persons and firms in Italy for agencies for U.K. manufacturers and exporters of aluminium ware, metals, chemicals, dyes, hides, skins, rubber, oils, soap, perfumery and scientific instruments. Inquiries should be addressed to the Secretary as above.

TARIFF. CUSTOMS. EXCISE.

Australia.—The importation of tinplate is prohibited, save with the consent of the Minister for Trade and Customs, as from September 25.

Canada.—The Orders in Council dated January 26, 1918, and April 11, 1918, prohibiting the transportation of silver spruce and the exportation and transportation of Douglas fir respectively are cancelled.

France.—The export and re-export of liquorice juice, hops and luperline are prohibited from French Colonies other than Tunis and Morocco to destinations other than France and French Colonies, as from November 21.

St. Lucia.—The export of gold, manufactured or unmanufactured, including coin and articles containing gold, is prohibited, except under licence, as from October 29.

South Africa.—As from October 1, all imports of wood pulp from Norway, Sweden, Denmark, Holland, Switzerland and Finland must be accompanied by a certificate of origin and interest.

United States.—Recent rulings of the War Trade Board affect hides, skins, rubber, raw cotton, salvarsan, neosalvarsan and arsphenamine.

With certain exceptions, all export licences which were unexpired on November 15 and all export licences issued on or after that date will be valid until used, unless revoked, notwithstanding such licences are stamped as expiring on November 15 or subsequently thereto.

All import licences issued on or after August 25 will be valid indefinitely unless revoked, provided it is not otherwise expressly stated in the licence.

The export from the United States to all parts of the British Empire of articles not included in the "Conservation List" will be permitted under general licence.

Licences may now be issued for the import of calcined spathic iron ore originating in and coming from the United Kingdom when shipped as back-haul cargo.

The procedure for the licensing of goods in transit from Canada or to Canada through the United States has been simplified. The special Import Licence for this glass of goods is to be known as "P.B.F. 25" and the Export Licence as "R.A.C. 56."

TRADE NOTES.

FOREIGN.

Foreign Companies, etc. *Germany.*—The Chemical Factory "Rhenania" at Aachen has acquired all the assets of the Rhenish Portland Cement Factory at Cologne for the sum of 1,675,000 marks.—(*Wirtschaftszeitung, Oct.* 18, 1918.)

An Association of the Lime Works of Central Germany has been formed with headquarters in Magdeburg.—(*Köln. Zeit., Oct.* 15, 1918.)

Opposition to the Lime Works Association is shown by the Gross-Hartmannsdorf (Bunzlau) Lime Works, which in a public print has stated that only 100 of the total of 1400 German lime companies have joined the Association, and of these 100 the majority was previously united by a joint selling agency. It condemns the formation of a trust, as this would only lead to restricted production and high prices—very undesirable ends in view of the present serious shortage of dwelling houses.—(*Z. angew. Chem., Nov.* 8, 1918.)

The Bavarian Nitrogen Works Co., Munich, has made a net profit of 1,195,213 marks as against 1,547,264 marks in the previous year. Over half a million marks has been placed to depreciation account, 85,452 marks is carried forward, and the dividend has been reduced from 14 to 11 per cent.—(*Z. angew. Chem., Nov.* 1, 1918.)

According to the *Tägliche Rundschau*, the Allgemeine Elektrizitäts Gesellschaft has floated a company—the Ukrainische A.E.G., Berlin—with a capital of 300,000 marks, to operate in the Ukraine.—(*Köln. Zeit., Nov.* 5, 1918.)

The report of the German (Auer) Incandescent Gas Light Co. for 1917-18 records a gross profit of 27,218,654 marks, but a fall in the net profits from 14,353,674 to 8,530,828 marks. This result is due to increased working costs and higher war taxes, and to the fact that war contracts now bring in much smaller profits. Preference shares get 5 per cent. and founders' shares 25 per cent. dividend.—(*Berliner Tageblatt, Oct.* 16.)

The United Aluminium Works in Frankfort, a subsidiary of the Griesheim-Elektron Chemical Works, has recently purchased a large plot of land in the Bautzen district, and it is presumed that the erection of a new aluminium works is contemplated. On adjoining Prussian soil this company has built the Lauta Works, which are nearly completed.—(*Köln. Zeit., Oct.* 22.)

At the general meeting of the German Gelatin Factories, Höchst a. M., the dividend was fixed at 16 per cent., and it was decided to move from Höchst to Frankfort. Discussing the outlook, it was agreed that the political situation would not greatly affect the company, provided always the Bolshevist tendencies did not get the upper hand. The close of the war would not do much to improve the supplies of raw material. The net profits equalled 539,846 marks, and a balance of 59,846 marks was carried forward.—(*Köln. Zeit., Nov.* 5.)

The Düsseldorf Dye Co. made a net profit of 44,529 marks in 1917-18 and has declared a dividend of 6 per cent.—(*Köln. Zeit., Nov.* 18, 1918.)

The Dresden Cellulon Manufacturing Co. has made a net profit of 1,339,631 marks and has declared a 20 per cent. dividend.—(*Köln. Zeit., Nov.* 18, 1918.)

Turkey. An Export and Import Co. has been floated in Smyrna with a capital of £T200,000. A number of new mining concessions has been granted by the Government, *viz.*, for a quicksilver mine in the Aidin vilayet, an emery mine in Sandjak Mendishi, two chromium mines and a coal mine in Adrianople vilayet, and a lead mine and petroleum wells in the Kastamuni vilayet. A new company has been formed in Afium-Kara-Hissar for the production of textiles and woven goods. Electrical works, agricultural schools, and settlements are to be established, the entire scheme involving a capital of £T500,000.—(*Wirtschaftszeitung, Nov.* 1, 1918.)

Rumania. Since the Peace of Bucharest Rumania has suffered from a boom in company promoting. Among the recent foundations figure the Industrial Requisites Co. (Lei 100,000), dealing mainly in machinery and implements for the oil industry, and the Agricola Industry (Lei 1 mill.), which will engage in the wholesale production of legumes (Lei = 9½*d.*). The chemical industries in Jassy and Bucharest have been enlarged by several new ventures. — (*Wirtschaftszeitung, Oct.* 25, 1918.)

The "Orion" oil company in Ploesti (capital 20 million Lei) is issuing shares to the value of 2 million Lei to enable it to sink at full capacity after the war.—(*Z. angew. Chem., Nov.* 22, 1918.)

Denmark.—A new chemical works, with the title "Koge Kemiske Fabrik A.-S.," is to be erected at Koge.—(*Wirtschaftsdienst, Oct.* 11, 1918.)

Italy.—The Industrie Chimiche Siciliane, at Palermo, which carries on the extraction of essential oils, etc., has raised its capital by 1 million lire.—(*Sole, Nov.* 16, 1918.)

REVIEW.

Treatise on Applied Analytical Chemistry. Vol. II. *By* Vittorio Villavecchia. *Translated by* T. H. Pope. *Pp. xiv and* 528, 105 *Illustrations and* 11 *Plates. (London: J. and A. Churchill,* 1918.) *Price* 25*s. net.*

The time is fast approaching, if it has not already arrived, when the general treatise on Applied Analytical Chemistry must give way to the specialised monograph. The amount of knowledge which has accumulated and been recorded during recent years in every department of commercial analysis is so great that only the monograph can conveniently accommodate it, and only the specialist can deal properly with the selection of matter and supply the discriminative element which make the best works of this kind so valuable to the ordinary worker. It is true that in the compilation of this volume, Prof. Villavecchia has had the advantage of the assistance of a number of well-known Italian chemists and that, consequently, the defects usually associated with the individual limitation are less apparent than is frequently the case in composite works of a similar character. As an example of an admirable and successful encyclopædic work on commercial chemical analysis, Allen's Organic Analysis occupies by general consent an outstanding position, but Allen only dealt with organic analysis, and even so, his treatise extended to eight very substantial volumes. In the volume under review—the second of the complete work—the author deals with meat products, with milk and its products, with starchy food-stuffs, with the various sugars and food-stuffs containing them, with alcoholic beverages, essential oils, varnishes, rubber and gutta percha, tanning materials of various kinds, inks, leather, colouring matters—both mineral and organic—textile fibres and fabrics. To say that this very large amount of ground has been in the main creditably covered within the space of some 530 pages, is to pay a high compliment to the distinguished author and his colleagues.

A detailed criticism of this work, even if any one person were competent to undertake it, would obviously be outside the limits of an ordinary review, and the points to which attention is drawn below must be regarded as a few examples of the main defect of this book, namely, the compression inseparable from the attempt to deal with so much and such widely varied subject matter within the covers of a single medium-sized volume. The wonder is that the sins of omission are not more numerous, and even an experienced chemist may peruse the sections which deal with the subjects with which he is most familiar, and find the perusal not unprofitable.

Dealing with individual points, it may be noticed with regret that for the estimation of nitrogen in meat and meat-products, the author recommends the use of oxide of copper and, finally, of potassium permanganate. It is very generally recognised that the permanganate has a marked tendency to cause low results and it is somewhat surprising that the Gunning-Arnold modification, which is now almost universally employed, should not have been recommended. The method described for the estimation of the various groups of nitrogenous substances in meat extracts, also, leaves a good deal to be desired. Thus, the method given for the estimation of the albumoses would obviously include gelatin. Gelatin, it is true, is referred to in an explanatory note, but no method for its estimation, or, indeed, for its detection, is given. Again, a not very satisfactory method for the detection of peptone is described, but no method for its estimation. Jaffé's method for the detection and estimation of creatinine is described, but there is no adequate reference to recent work on this subject. The statement that "this investigation is of particular importance in testing for meat extract in vegetable or yeast extracts" is obviously rather wide of the mark. The operator, moreover, is informed that the orange colour with alkaline picrate is also given by acetone and, should the meat extract contain that substance, the liquid should be boiled before testing. No reference is made to the fact that the same coloration is produced by glucose and other sugars which are very much more likely to be present than acetone.

Some of the numbers given in the statement at the end of the chapter on Meat Extracts dealing with the analytical data which should characterise a satisfactory product, will certainly not be generally assented to. Instructions given in the section on Tinned Meats for the detection and estimation of metallic impurities are open to some criticism. In the detection of tin, for example, the method described is such that even heavy traces would be very liable to escape detection, the method involving the treatment of the ash with nitric acid, and the operator being told to test the residue on the filter paper "for tin and antimony by the ordinary methods." Working on 50 grms. of the sample and dealing with such quantities of tin as would be likely to be present in most tinned meats, the "ordinary methods" would scarcely suffice. No mention is made of Schryver's colorimetric process, which is admirable for this purpose.

In dealing with the estimation of arsenic, no reference is made to the necessity for the use of lead acetate paper in the calcium chloride tube of the Marsh-Berzelius apparatus. In this section, instructions are given to destroy the organic matter and to test the resulting liquid in the Marsh flask. No information, however, is given as to the method of estimation by comparison of mirrors, and the operator is informed that the amount of the arsenic may be determined by weighing the deposit in the heated tube!

The chapter on the analysis of Sugars and Saccharin Products is very disappointing, and is an excellent example of the disadvantage of attempting to cover too much ground in too little space. The methods to be adopted for the analysis of mixtures containing the various sugars have, in order apparently to save space, been generalised in the form of numerous equations, and certain portions of this chapter have rather the appearance of a mathematical treatise than of a text-book of chemical analysis. If descriptive matter had taken the place of the equations and an example of each problem had been given and worked out, the result would have been vastly more useful. As it is, the expert sugar analyst is scarcely likely to experience the need of consulting this volume, whilst the more or less inexperienced analyst could scarcely fail to find himself hopelessly at sea. It may be noticed, in passing, that Wein's table for converting reduced copper into its equivalent of maltose and which is generally recognised to be incorrect to the extent of about 5 per cent., is reproduced. In the special part of this chapter a good many matters for criticism have obtruded themselves upon the reviewer's notice. Thus, the question of the determination of the various carbohydrates in commercial glucose is dismissed with the statement "the exact determination of the separate sugars is not easy. . . . It is usual, therefore, to calculate the whole of the reducing sugars as glucose." The water in these sugars is to be determined by drying at 105° C., a method which is known to be exceedingly inexact. For the estimation of dextrin, the author recommends hydrolysis with acid and the calculation of the whole increased reducing power as dextrin, thus obviously ignoring the maltose present. In solid glucose it is well known that there is, as a rule, little or

no dextrin, but appreciable quantities of maltose. In the case of liquid glucose, on the other hand, there is much maltose and the method would give startling results. It may be noted, by the way, that in the explanatory note referring to the composition of glucose syrups, no mention whatever is made of the presence of maltose, which usually constitutes over 30 per cent. of this product. Conversely, in dealing with the estimation of dextrin in malt extracts and malto-dextrin products, no provision is made for the dextrose almost invariably present. In dealing with the estimation of the diastatic power of malt extracts, no mention is made of Lintner's method, which is almost universally employed.

The chapter on Beer has been very largely rewritten for the English edition by Mr. T. H. Pope, in order to bring it more into line with English conditions. It need scarcely be said that it has been well done and that it constitutes a safe guide to the analyst. The statement that the presence of organic matter prevents the estimation of the arsenic in beer is not in accordance with the writer's experience. In dealing with such an important matter as the estimation of arsenic in food-stuffs, it is surprising that, notwithstanding the frequent reference to the Marsh-Berzelius method, nothing is said of the "insensitiveness" of much of the zinc supplied specially for the purpose. In a book intended for the general practitioner and not for the expert, this is a rather serious omission.

The sections dealing with Wines and Spirits have been in the main well written. It should be pointed out, however, that for the determination of the higher alcohols no mention is made of the Allen-Marquardt method, which is generally recognised to be one of the most accurate for the purpose. The colorimetric methods given in the book and described at some considerable length are both inexact and greatly inferior.

The chapter dealing with the Essential Oils is, like the chapter on the Sugars, a very good example of the disadvantage of endeavouring to crowd too much matter into a small amount of space. This chapter, which extends to only 24 pages, actually attempts to deal with essential oils in general and in detail with some of those which are of outstanding commercial importance. It is not to be wondered at that there is not much to be found of value to the expert, whilst there is no real guidance for the less experienced worker, and there are many omissions which might possibly lead him astray. To criticise this at any length is out of the question, but attention may be drawn to the fact that in the section on lemon oil, the very incorrect method of Berté for the estimation of citral is given. The statement that, by this method, lemon oil contains 6 to 7·5 per cent. of citral is in itself enough to condemn it, seeing that, as a matter of fact, this oil does not as a rule contain more than about 3 per cent. Incidentally it may be mentioned that hop oil does not contain carvacrol.

The chapter on the mineral pigments appears to be on the whole accurate, but it is clear that here again it is impossible to deal adequately with so large a subject in so small a space, a criticism which applies with even greater force to the section dealing with organic colouring matters.

In the section on Indigo, it may be noted that no reference is made to Bloxam's tetra-sulphonate method for the estimation of indigotin, which is certainly more accurate than that described.

Whilst there is, throughout the book, evidence of too great compression, one finds, on the other hand, that an undue amount of space has been devoted, in certain of the chapters, to methods of detecting and estimating impurities and adulterants which are rarely, if ever, met with in ordinary practice and which might well have been dismissed with a very brief reference.

There appear to be very few typographical errors and the paper and printing are good. Mr. Pope's share of the work has been excellently done, but one feels inclined to wonder whether the value to the analyst of a book such as this bears any adequate proportion to the amount of work involved in its preparation.

A. CHASTON CHAPMAN.

PERSONALIA.

The death is announced of Prof. Nietzki, professor of chemistry of the University of Bâle, at the age of 71. Prof. Nietzki made important contributions to organic chemistry, more particularly in the field of organic dyes. He was the discoverer of "Biebrich Scarlet" and nitranilic acid, and was the author of important investigations on aniline black, the quinones, azo-derivatives, safranines, oxazines, and the thiazines.

The following candidates connected with the chemical industry were returned as Members of Parliament at the recent General Election:—Lieut.-Col. Grant Morden, of the British Cellulose and Manufacturing Co., Ltd., for Brentford and Chiswick (Middlesex). Sir Wm. Pearce, of Messrs. Spencer, Chapman, and Messel, Silvertown, E., for Limehouse (Stepney). Mr. J. W. Wilson, of Messrs. Albright and Wilson, Oldbury, for Stourbridge. Sir Alfred Mond, of the Mond Nickel Co., etc., for Swansea (West). Col. Sir E. A. Brotherton, of Messrs. Brotherton and Co., Leeds, for Wakefield. Sir Richard Cooper, of Messrs. Wm. Cooper and Nephews, Berkhamsted, for Walsall. Mr. A. F. Bird, of Alfred Bird and Sons, Ltd., for Wolverhampton (West).

The Order of Knight Commander of the British Empire (Civil Division), K.B.E., has been conferred upon: Prof. W. J. Pope, President of the Chemical Society and member of the Chemical Warfare Committee, Ministry of Munitions; Dr. A. Strahan, Director of the Geological Survey of Great Britain; and Mr. W. J. Jones, member of the Iron and Steel Production Department, Ministry of Munitions.

The Order of Commander of the British Empire, C.B.E., has been bestowed upon: Prof. J. W. Cobb, Deputy Inspector of High Explosives, Ministry of Munitions, and Principal J. C. M. Garnett, of the Municipal College of Technology, Manchester. The new Officers of the same Order, O.B.E., include: Mr. C. S. Gibson, Mr. F. Holt, of the Castner-Kellner Alkali Co., and Dr. W. E. S. Turner, Secretary of the Society of Glass Technology.

PUBLICATIONS RECEIVED.

THE NATURAL ORGANIC COLOURING MATTERS. *By* A. G. PERKIN *and* A. E. EVEREST. *Monographs on Industrial Chemistry, edited by* SIR ED. THORPE. *Pp.* 655. *(London: Longmans, Green and Co.* 1918.) *Price* 28*s.*

RECENT ADVANCES IN ORGANIC CHEMISTRY. *By* A. W. STEWART. *Third edition. Pp.* 350 *(London: Longmans, Green and Co.* 1918.) *Price* 14*s.*

CATALYSIS IN INDUSTRIAL CHEMISTRY. *By* G. G. HENDERSON. *Monographs on Industrial Chemistry, edited by* SIR ED. THORPE. *Pp.* 202. *(London: Longmans, Green and Co.* 1919.) *Price* 9*s.*

THE TECHNICAL CHEMIST AFTER DEMOBILISATION.

The problem of providing useful and fitting occupation for those who will shortly be leaving H.M. forces, munition works and ancillary branches of war service is nowhere more difficult than where it relates to the technical chemist. It is of paramount importance to the nation that his very special and indispensable knowledge and training should be utilised to the full, yet, notwithstanding the universal application of chemical principles to modern industrial processes and to the provision and maintenance of healthy and comfortable conditions of living, it may not be easy to allocate all the technical chemists whose services will shortly cease to be required in connexion with war work to other work in which they will be able to do full justice to themselves, their training and experience, and the occupation which may present itself to them. The difficulty will be greatly minimised if the authorities and the public at large will refrain from regarding technical chemists leaving the services, etc., as so many "hands" seeking employment, and will instead take the proper view that they are national assets of enormous potential value, for the realisation of which it is only essential that each should be afforded the occupation for which his special attainments best fit him.

Some men will undoubtedly return to their former work in the honourable but hitherto poorly remunerated profession of teaching, the better equipped therefor in virtue of their transient first-hand acquaintance with, *e.g.* the application of chemistry to industrial work, the foibles of the artisan and skilled labourer, the inspiring confidence of the engineer, or perchance with technical research pure and simple. Others who have not hitherto essayed to instruct may also find their rôle in our technical colleges, where many more students of chemistry may be expected than hitherto, and undoubtedly the pupils will benefit from the war-time experiences of their instructors. Many men again will return to former positions in connexion with the public services—*e.g.* sanitation, water and gas supply, etc.—from which they have been ill-spared during the war, and with them also will go others, whose acquaintance with such services has been made through military requirements. There is scope for many more trained chemists in these services than were generally engaged therein prior to the war, both at home and abroad—where, especially in the territories in the East and in Africa which have recently come under the control of the Allies, the chemist, with the assistance of the engineer and the medical man, has tremendous opportunities of contributing to the health and prosperity of large populations, hitherto little cared for. War experiences will in many instances have fitted him to act in administrative capacities which have commonly been filled in the past by the non-technical civil servant, or by the engineer, or the medical officer, though chemistry should have played a larger part in them than letters, engineering or medicine. It is to be hoped that the war will have dissipated the widespread impression that the chemist, as such, is incapable or inefficient as an administrator. Certain it is that administrators (who may be born not made) are the better for a sound training in chemistry, and that they may be sought for and found in the ranks of technical chemists now returning from the field of war or leaving munition works.

There are other opportunities for the released technical chemist to play his part which need not be detailed here, but it is obvious that his greatest scope will be in chemistry directly associated with industry. Apart from chemical manufactures proper there are allied manufactures and industries in which the chemist can render very great service. Those manufacturers who are setting out to capture new branches of trade, or to revivify by new methods old branches, should consider whether they cannot avail themselves with advantage of the assistance of a trained chemist. It is a fact that much of the industrial success of the German manufacturer in the years before the war was due to his appreciation of the value of a chemist's services and advice, and to the lack of the same on the part of his rivals in other lands. The war has demonstrated, however, that the British chemist—little appreciated though he may have been in his own country—has, in the emergency, equalled and surpassed in inventiveness, resourcefulness and thoroughness, the much-vaunted German chemist. The lesson is one which the British industrialist and manufacturer should take to heart. If he does so, he will seize the present unequalled opportunity of securing, for the benefit of his undertaking and business, services which have stood the country in such good stead during the last few strenuous years of what has been aptly called "the chemist's war." The men who have done more than any other group of equal numbers towards winning the war only need fair play and reasonable opportunity to enable them to win for British industry an unqualified predominance over its erstwhile rivals.

How can the manufacturer, the public authority or other body which seeks to grasp the present opportunity of enlisting the help of a technical chemist get into touch with the man who is best qualified to fulfil the particular requirements of the case? In the first place, the requirements and expectations should be specified fully and frankly, so that there may be no ground for misconception on the part of any chemist who offers his services, with perhaps consequent mutual dissatisfaction after a brief period of attempted collaboration. On the other side it is incumbent on the technical chemist, in common fairness to a man or body of men who seek his aid but do not realise the wide ramifications of chemistry, to state the range of his technical experiences, his limitations and the prospects of research in the branch of work dealt with. If advertisement in the technical press is the means selected by either party to the proposed engagement for acquainting the other with his needs or aspirations, a sufficiently full, though concise, statement is desirable with a view to avoiding futile correspondence and trouble. The same caution may be tendered to those offering or seeking engagements through bureaux such as that which the Institute of Chemistry has established, to which we take this opportunity of drawing the attention of manufacturers and others who may be needing the services of a technical chemist at the present juncture.

Chemical manufacturers proper need no suggestions from us as to how and when to increase their staffs of trained chemists, but it may be useful to remind others that our technical colleges have been almost devoid of students during the last two or three years, and that consequently there can be no appreciable increase in the number of trained chemists available for appointments until those now entering the colleges complete their three or four years' course of training. Hence when the technical chemists now leaving the services, etc., have secured appointments, it is likely that—in say 6 or 12 months' time—it will be difficult for those then needing the assistance of one to obtain it without delay.

THE FEDERAL COUNCIL FOR PURE AND APPLIED CHEMISTRY.

That union gives strength is widely recognised in theory, though in practice the tendency, of late years, has been towards the multiplication of small states even within the realm of chemical science. Nevertheless, it has long been felt that, whilst the interests of chemists are now represented by a large number of special Societies, these are in need of co-ordination and unification, as well as social development. On the professional side, we have to recognise that an indubitable advance has been made during the war by the Institute of Chemistry —a body clearly destined to be the agency through which professional standards of competency and conduct will gradually be formulated and determined; ultimately this should rank with similar institutions controlling the legal and medical professions. Trade interests, in like manner, are now satisfactorily cared for by the Association of British Chemical Manufacturers; though of recent origin, on account of its representative character, the magnitude of the interests it covers and its activity, this body has already taken a commanding position.

Action was called for on behalf of the interests of Chemical Science, pure and applied, the effect of which would be ultimately to secure for the profession of Chemistry—as distinct from Pharmacy—the recognised status and homogeneity enjoyed by other learned professions by uniting the various sections for all the purposes of scientific service. From this point of view, the recent establishment of a Federal Council, composed of delegates appointed by the several Societies, will be generally welcomed as a step of the first importance. That the time was ripe for such action is clear. During the war, the value of the chemist has been constantly under notice and probably the public now realise, as they never did before, how indispensable his work is both for the welfare and the defence of the country. On the offensive side, the war has been essentially a chemists' war and had it been continued, in the near future, the horrors of the earlier period would have been far exceeded, owing to the development of the means of attack by poisonous vapours. The safety devices which have played so great and successful a part in countering this new means of warfare have been entirely the product of the chemist's ingenuity, but he has played an alleviating part in not a few other directions.

Not only is there much overlapping and duplication of effort, especially in the matter of publications, but no machinery existed whereby the collective and considered opinion of all workers in chemistry could be made fully operative, either constructively or in defence of privileges and interests; moreover, there was no means by which the advice of the body in general could be taken and tendered for public purposes, the result being that limited and incompatible views were not infrequently expressed when inquiries were made by official bodies.

The need of securing the co-operation of the various agencies now in existence was brought prominently under notice by the President of the Chemical Society in his address to the Fellows in April last. Impressed by the necessity of taking time by the forelock, he soon afterwards took the further step of calling together a few of those who were specially concerned in forwarding the advance of chemical interests to discuss a scheme of Federation, with the result that it was resolved that action be taken forthwith to secure the formation of a Federal Council with certain defined aims and objects. It was agreed that the ultimate aim should be the establishment of a Federation of all the bodies specially interested in the development and application of Chemical Science. In such an Association, the constituent bodies representative of particular interests should maintain their individuality and each be the organ of its proper branch of activity; but they would unite in considering all matters of concern to the general body, as well as in supporting the publications of the Federation and in maintaining a House where all meetings could be held and the official staff find accommodation, together with a complete library.

It is to be foreseen that not only will it be necessary to maintain the publication of Abstracts such as are now prepared, but to undertake also the preparation of such works of reference as may be required by chemists for scientific and industrial purposes.

A necessary feature of the enterprise would be the foundation of a Club open to all members of the Federation who were prepared to pay the Club dues.

A precedent for the Federation of Chemical interests in the manner outlined is afforded by the Royal Society of Medicine, established in 1907, in which are incorporated all the various Societies—to the number of 20—concerned with the development of the Science of Medicine but excluding the Colleges which have professional interests in their charge. This Society publishes proceedings in which the work of the several Sections is recorded—but with distinct pagination, so that the publication of each Section may be issued or bound separately. Each Section is represented on the Council of the Society by its President. The Royal Society of Medicine has its quarters in a large building in Wimpole Street, constructed at a cost of £50,000. Originally it was proposed to afford Club accommodation on a story at the top of the building: from motives of economy, this proposal was not carried into effect; it is now much regretted that such was the decision.

The scheme was communicated in broad outline to the various bodies more or less closely concerned, with the request that they would appoint delegates to a Council which might seriously take the matter into consideration. It may be mentioned that the Institute of Chemistry was not included as a constituent body, as it was felt that possibly there might be occasions when the Council and the Institute would need to be free to take an independent course. It was specially provided for, therefore, by co-opting its President or such other member as the Institute might determine. The Chemical Society was requested to act through its representatives as Convener of the Council should the bodies consulted or a preponderating number thereof approve of the proposal.

As the result of the deliberations of the delegates appointed by the various bodies, a Federal Council has recently been constituted which is to be composed of nominees of the corporate Societies covering all aspects of Pure and Applied Chemistry, the purpose of the Council being to take such action as will ensure the adequate appreciation of the due claims of Chemical Science.

The Council will consider all matters involving the common interests of its constituent bodies and take appropriate action in connexion therewith after consultation with any bodies more immediately concerned or identified with the matters under consideration. Further, it will consider such references as it may from time to time receive from its constituent bodies or otherwise and act thereon if desirable.

The Institute of Chemistry, whilst not a constituent body, is associated with and represented on the Council, freedom being reserved to the Institute as the professional body to carry out its duties in accordance with its Charter.

The action taken by the delegates has been reported to the several Societies, who have confirmed their adhesion and the appointment of their representatives.

The Council is to be known as "*The Federal Council for Pure and Applied Chemistry (to advance, safeguard and voice the interests of Chemical Science)*".

The constituent bodies already included are: *The Chemical Society* (3 delegates: Profs. Armstrong and Pope and Sir Wm. Tilden); *The Society of Chemical Industry* (3 delegates: Prof Louis, Drs. Keane and Miall); *Association of British Chemical Manufacturers* (3 delegates: Mr. R. G. Perry and Drs. E. F. Armstrong and C. Carpenter); *Institute of Chemistry* (co-opted: Sir Herbert Jackson); *Society of Public Analysts* (Dr. Rideal); *Faraday Society* (Mr. W. R. Cooper); *Biochemical Society* (Dr. Plimmer); *Institute of Brewing* (Mr. A. Chaston-Chapman); *Society of Dyers and Colourists* (Mr. C. F. Cross); *Ceramic Society* (Dr. J. W. Mellor); *Society of Glass Technology* (Dr. W. E. Turner).

Prof. Pope is Chairman and Prof. Armstrong will act as Honorary Secretary of the Council, which is to enjoy the hospitality of the Chemical Society's Rooms in Burlington House.

The steps to be taken towards establishing an Association or Guild of Chemical Societies and the provision of a House for the accommodation of such a body have already engaged the attention of the Council, and a Committee has been appointed to deal with these problems.

The Council has addressed a letter to the President of the Board of Trade urging the need of the representation of Chemical Science on the Advisory Board appointed to assist the Dyes Commissioner.

A letter has been forwarded to the Vice-Chancellor of the University of London, with reference to recent announcements as to the appointments to University Chairs of Chemistry in the University, expressing the opinion that the salaries attached to such Chairs should be more in accordance with the scale prevailing in offices which may be regarded as likely to be in competition with Professorial appointments.

On reference from the Chemical Society, the Council has appointed a Committee to take into consideration the production of the special chemicals required in research work; and has also addressed a letter to the Royal Society expressing the opinion, that the grants available in the past for chemical research have been inadequate, and that in future much larger sums should be made available under conditions more likely to encourage an increased number of competent workers; also asking whether the Society would be prepared to advocate a large increase in the sum placed by Government at the disposal of the Society and whether it would desire to see the whole situation reviewed and a more comprehensive and unified scheme developed for the administration of grants.

BULLETIN OF SCIENTIFIC AND TECHNICAL SOCIETIES.—A very useful diary of forthcoming meetings is now being issued fortnightly by the Conjoint Board of Scientific Societies (Royal Society, Burlington House, W. 1). Announcements of meetings should be sent by secretaries of societies to: Prof. R. A. Gregory, "Nature" Office, St. Martin's St., W.C. 2.

SOCIETY FOR THE ADVANCEMENT OF CHEMICAL EDUCATION.—A new society with the above title has recently been formed in Germany to promote chemical education in universities by providing funds for teaching purposes and for research. The society is to have a capital of 30 million marks, and the minimum subscription has been fixed at 10,000 marks, which may be paid in ten annual instalments of 1000 marks.

THE CONCEPTION OF THE CHEMICAL ELEMENT AS ENLARGED BY THE STUDY OF RADIO-ACTIVE CHANGE.

In a lecture before the Chemical Society on December 19, 1918, Prof. Soddy has summarised very clearly the modifications which have been brought about in the conception of the chemical element and in our views of the ultimate constitution of matter by the study of radio-active change.

Prior to the discovery of radio-active disintegration, the expansion of chemical knowledge had not rendered necessary any fundamental change in the simple and practical definition of an element which we owe to Boyle, who described the element as a substance which could not by any means be separated into different substances. The first phase of radio-active research, which was concerned mainly with the disentanglement of the long and complicated series of successive changes in the uranium and thorium series, had the effect of robbing the chemical element of its time-honoured title to be considered the ultimate unchanging constitutent of matter, but in so far as the transmutations revealed by these investigations were spontaneous and uncontrollable by any known agency, this phase had no essential influence on the conception of the element as originally defined by Boyle.

The introduction of the atomic theory tended to divert attention from the element to the atom as the ultimate constituent of matter. The element became a plurality of atoms supposed to be in every respect identical. This assumption of the identity of the atoms, implicitly accepted throughout the nineteenth century as a characteristic of each and every chemical element, was in conformity with all the known facts, and history records no alternative hypothesis other than that put forward by Sir W. Crookes in his theory of the meta-elements as applied to the rare earths.

The effect of the discovery of the periodic law was merely to replace the older practical definition by a theoretical conception, according to which the occupancy of a particular place in the periodic table became the fundamental criterion of an element. Associated with this place were unique chemical properties, unique atomic weight and unique spectral characteristics.

It is the second phase in the development of radio-active research, however, which has revealed the necessity for modifications in the nineteenth century conception of the chemical element. These changes are the result of the study of the chemical nature of the successive disintegration products, of the recognition of the law connecting this with the type of ray expelled in the radio-active change, of the discovery of elements which differ in their radio-active properties but are chemically identical, and finally of the recognition of these as isotopes or elements which occupy the same place in the periodic table.

The theory and practice of radio-activity have been greatly simplified by the proof of the fact that the expulsion of the α-particle is accompanied by a shift of two places to the left in the periodic table and that the β-ray emission causes a shift of one place in the opposite direction. The known radio-active series extends over twelve places in the table, the places corresponding with the halogen and alkali metal groups being entirely skipped. In the ten occupied places there are forty-three distinct types of matter, characterised by distinct radio-active properties, but these forty-three types represent only ten chemically different elements. The chemical and spectroscopic characters of seven of these, namely thallium, lead, bismuth, emana-

tion, radium, thorium and uranium, are firmly established, and the seven places which these occupy in the periodic table accommodate all but nine of the known radio-elements. Isotopy is here manifested on a considerable scale. The isotopes may have different atomic weights (heterobaric isotopes) or the weights of the atoms may be the same (isobaric isotopes). Similarly, elements which occupy different places in the periodic table (heterotopes) may be differentiated as heterobaric and isobaric, according to whether their atomic weights are different or are identical. It may very well be that elements which up to now have been considered homogeneous are in reality mixtures of chemically identical isotopes.

In explanation of these relations, the structure of the atom is supposed to correspond with a miniature solar system in which the externally revolving particles (electrons) determine the chemical and spectroscopic characters of the atom, whilst the mass and the radio-active properties are determined by the nucleus or core.

Although, as Prof. Soddy points out, Nemesis has indeed overtaken the most conservative conception in chemical science, yet the newer discoveries do not in the least affect the practical importance of the conception of the element which was in vogue before the radio-active era; this will continue to have a real significance as representing the limit of the spectroscopic and chemical analysis of matter.

CASTOR OIL FOR AIRCRAFT ENGINES.

An enormous demand for castor oil for aircraft engines has sprung up within the last year or two, and very important developments in the castor seed and oil industry have accordingly taken place, especially in the United States. India has hitherto been the chief source of supply; the exports of seed and oil from that country during the last few years having been as follows:—

	Castor seed	Castor oil
1911–12	120,194 tons	1,404,403 galls.
1912–13	110,630 ,,	954,495 ,,
1913–14	134,888 ,,	1,007,001 ,,
1914–15	82,815 ,,	898,269 ,,
1915–16	87,950 ,,	1,451,655 ,,
1916–17	92,447 ,,	1,723,469 ,,
1917–18	86,100 ,,	2,086,038 ,,

Both before and during the war about half the seed exported has been sent to the United Kingdom, the bulk of the remainder going to France, Italy, and the United States. Belgium took large quantities before the war, probably for re-export to Germany. Most of the oil exported from India before 1914 was shipped to Australia and other Colonies, but during the war increasing quantities were consigned to the United Kingdom. The total imports of castor oil into this country in 1916 were 1,322,000 gallons, and the figure for 1917 would probably be about 2,000,000 gallons. The imports of castor seed in 1917 were 45,000 tons, the bulk of which went to Hull either direct or *via* Liverpool. Assuming a practical yield of oil of 40 per cent., 45,000 tons of seed would yield about 18,000 tons of oil, which, at 232 gallons to the ton, is equivalent to 4,176,000 gallons. Adding this to the import of oil we arrive at a total of 6,176,000 gallons of oil, the greater part of which has probably been used for aircraft engine lubrication.

In the United States it was realised at an early date that at least 5,000,000 gallons of castor oil would be required for aeroplane engines, and, as the imports of seed and oil would only supply a very small fraction of this quantity, arrangements were at once made for cultivating the crop on a very large scale. The U.S. Government has entered into contracts with the farmers in the Southern and Pacific Coast States, undertaking to supply the necessary seed and to pay up to 3·5 dollars per bushel when harvested. It is understood that the British Government has released about 7,000 tons of Indian seed for planting in the United States, and that the total area planted will be over 100,000 acres.

In addition to this castor oil the U.S.A. Signal Corps has, as a result of protracted experiments, introduced another lubricating oil manufactured from petroleum, and called "Liberty Aero Oil." This is intended to eke out the castor oil supply pending the harvesting and crushing of the seed, and will be used more especially for the stationary cylinder aircraft engines, including the famous Liberty engine, the castor oil being used exclusively for rotary engines.

Stringent specifications have been drawn up by the U.S. War Department both for the Liberty Aero Oil and also for castor oil (specifications Nos. 3501 and 3500A respectively). The castor oil specification No. 3500A stipulates that the oil must be colourless; sp. gr. 0·959—0·968 at 60° F.; completely soluble in four volumes of 90 per cent. 0·834 sp. gr. alcohol at 60° F.; maximum acidity not to exceed the equivalent of 1·5 per cent. oleic acid; iodine number, 80—90; saponification number, 176—187; unsaponifiable below 1 per cent.; must contain no rosin, rosin oil or cotton seed oil; viscosity (Saybolt) 450 secs. at 130° F. or 95 secs. at 212° F.; flash-point 450° F. in a Cleveland open flash cup; freezing point, below zero F.

Owing to the very great and ever increasing demand for castor oil, attention is being given to the cultivation of the castor bean all over the world. Small quantities of seed or oil have been exported in the past from Brazil, Cochin China, and Manchuria, and the industry is being rapidly extended in these countries. The Brazilian crop in 1918 has been nearly destroyed by frost, but it is hoped that the yield for 1919 will be 2,000,000 bags of seed.

In the West Indies about 100,000 acres have been planted with Indian seed. In Malaysia the Federated Malay States Railways have had about 50 acres planted on the railway reserve, and managers of coconut and rubber estates, as well as native farmers, are interesting themselves in the cultivation. In Malaga (Spain) one or two firms of olive oil refiners are entertaining the idea of castor oil extraction, and are encouraging the local farmers to grow the castor bean. One of these companies expects to produce about 60 tons of oil this year, and another is inquiring for American machinery capable of turning out 10 tons in a 10-hour day.

In regard to American oil-milling machinery it may be here stated that some tests on castor seed crushing recently took place at Jacksonville, in Florida, with four types of American oilseed crushing machinery. One of these was built by the Southwest Manufacturing Co. of Oklahoma City, two were built by the Seminole Manufacturing Co., and one by the Appomattox Iron Works, Petersburg, Va. A very large oil-mill has lately been completed at Gainesville, Florida, and is said to be one of the largest in the world. It will deal with the bulk of the U.S. castor seed crop for 1918.

Other countries interested in the castor bean cultivation include Japan, where the possibilities are very great, although little has been done hitherto. Venezuela is also well suited for the castor bean, and a grower at Caracas has collected several varieties for test. The Venezuelan Agricultural Experiment Station has published a booklet containing instructions for growing the *tartago*, as the castor bean is known locally. Java is growing the plant on a commercial scale. In Siam it is found growing wild nearly everywhere, and a Bangkok

merchant has cultivated a large crop from which he expects to harvest about 1000 tons of seed. In New South Wales some seed has been grown near Gosford, and the oil expressed therefrom. In Africa the plant is already found in the Congo, Uganda, East Africa, and it has been suggested as a very suitable crop for French West Africa. Attempts are being made to introduce it into the Transvaal. According to an American consular report, the Italian Minister of Agriculture has appealed to the farmers in Catania to take up the cultivation of the castor oil plant, offering to furnish seed and buy the crop at a good price. Very large quantities of castor oil are wanted in Italy for aircraft engines.

SUGAR BEET SEED.

F. V. DARBISHIRE.

When the war broke out the world's annual sugar beet seed requirements were roughly 79,000 tons, an amount which represents the seed sown annually on, say, 6 million acres of land. In peace time Germany had enjoyed an undoubted and well-established monopoly in the export trade of beet seed, no less than 78 per cent. of all beet sugar produced outside Russia and Germany being from German grown seeds. In the United States the beet sugar industry needs annually about 6000 tons of seeds, 4000 of which was formerly bought from Germany. Cantley, our one and only beet sugar factory, was closed down early in 1916 owing to lack of seed—another striking illustration of the danger of depending on a foreign country for some essential raw material. France, Austria, Holland and Russia grow and even export some of their native seed, and for quite a number of years efforts have been made in the United States to establish the native beet seed industry on a more extensive scale and on a thoroughly scientific basis. Good progress has been made in that country, especially since 1915. In 1917 the production reached 2773 tons of seeds, an increase of 6 per cent. on the 1916 crop.

It is interesting to note that on the Kelham Estate in Nottingham, where 5600 acres was purchased for the purpose of erecting a beet sugar factory, a small area is under beet cultivation for seed, in order to ensure an adequate supply of good seeds for planting in 1920. Sugar chemists and others interested in developing beet seed production in the States are fully alive to the many difficulties which confront them. Marggraf himself in 1747 discussed the possibility of raising the sugar content of the beet artificially, though it was not until Vilmorin, the father of modern beet breeding, started his researches in 1830 that the study of the creation of new varieties of beet became serious. The beet has now been so highly developed during many generations that its tendency to revert to a previous inferior type, *Beta maritima* or *Beta vulgaris*, is very pronounced: only by continuous and persistent application of the most modern scientific methods can it be kept up to its high standard. For sixty years German beet seed producers at Klein Wanzleben in Saxony have been labouring continuously to improve the original beet and have succeeded in creating new forms or types. Remembering that these investigations are carried out by reliable experts with the greatest possible care and patience, it is not surprising to find that the best German grown seed is also the best seed that can anywhere be procured. It is called super-élite seed, and never gets into the market: if it did it might fetch anything up to about £12 an ounce. In addition to the super-élite variety, there are also the élite and commercial seeds. Super-élite and élite seeds are obtained from carefully selected mother beets which have passed all prescribed chemical and physical tests. Super-élite seeds are obtained from mothers truest to type; they are kept separate, and from them are bred further generations of super-élite and élite seeds. These latter seeds are obtained from mothers which are found to be somewhat inferior to the truest type. The commercial seeds are the next generation to the élite seeds, grandchildren so to speak of the original mother beets. It is perhaps not generally known that it takes at least five years of very strenuous scientific work to harvest a crop of commercial seeds. In the first year the original selected strain of super-élite seeds is planted, and after ripening in the autumn all those roots which pass the physical and chemical tests are siloed through the winter and are known as mother beets. In the second year the mother beets, after further testing, are planted out, and in the autumn yield, as already explained, super-élite and élite seeds. The former are withdrawn for breeding purposes, and the latter are sown in the third year. These are placed so close together, however, that the plants grow long and slender and are known as stecklings. They are gathered in the autumn and siloed during the winter months. In the fourth year these stecklings are planted out and in the autumn yield a crop of commercial seed, which may be sown in the following spring, ripening five to six months later in time for the opening of the autumn sugar campaign of the same year.

We owe to Mr. Palmer, who is well known through his Loose Leaf Beet Sugar and other publications, the appearance of a small book* on the production of beet seeds of which he has made a special study. It is full of interesting, accurate and up-to-date matter, and contains many excellent photographic reproductions. It does not pretend to be a text book, but has been written for the purpose of giving general information. In one of the concluding sections he touches briefly upon a problem which is causing much discussion among specialists and to which much scientific energy is being devoted, more specially in America. This problem concerns the possibility of creating single germ seed balls by selective breeding. Each seed ball of the sugar beet contains 1—7 distinct seeds, and on an average 3½ plants germinate from each ball. The seed balls are drilled into the ground towards the end of April; a couple of weeks later, when the plants possess about four leaves, thinning out takes place, so that the single plants stand about 8—12 inches apart in the row. Thinning out is a slow and tedious process, and although usually performed by children, an expensive one. Moreover, since several plants grow up together on the very same spot, their respective rootlets are generally tightly grown together. The removal of the superfluous, weaker plants is bound to act injuriously on the growth and health of the single remaining plant; and hence the necessity of breeding single in the place of multiple seed germ balls. Since the year 1903, the possibility of realising this change has been investigated in the United States. Judging from the results already obtained, there appears to be no longer any doubt, according to Mr. Palmer, that this new character can be acquired by the beet, and that it will become permanently fixed. In the fourth generation already many plants produced 60—70 per cent. of single seed balls; on a few individual plants as many as 85 per cent. of single germ balls were counted. When, finally, chemists and botanists have increased the disease-resisting power of the beet, they will by their united efforts have produced a very perfect new farm crop.

* Sugar Beet Seed. History and Development. By Truman G. Palmer. (New York: John Wiley and Sons, Inc.; London: Chapman & Hall, Ltd.)

NEWS FROM THE SECTIONS.

LIVERPOOL.

At a meeting held jointly with the Liverpool Engineering Society on December 18, 1918, a paper was read by Mr. H. S. Rowe on "The Growth and Arrangement of Industrial Boiler Plants." The paper reviewed the many aspects of the subject in some detail and contained many valuable statistics; it will be published *in extenso* in the Transactions of the Liverpool Engineering Society.

The type of plant considered was one which had started in the smallest way with one boiler and had grown and developed in a quite unsystematic manner according to the expansion of the business for which it was required. The industrial conditions both as regards supply of fuel and the efficient production of an adequate supply of steam were reviewed, and the causes of defective steam supply were considered.

Heating surface and economisers were the next aspects dealt with, the latter being discussed in some detail. The extent of output, average rate of firing for the practical limit of fuel-burning capacity of the furnace, amount of labour required by the plant and the important question of draught were all reviewed, much statistical matter dealing with draught and the percentage of carbon dioxide in the chimney gas being given.

Finally the space occupied by a plant was discussed, as also the growth and arrangement according to the principles described under the previous headings in the paper; and tables showing how the capacities of boiler plants lend themselves to be increased were given as well as diagrams showing the lay out of typical plants.

BRISTOL.

An informal meeting, held at Bristol on December 19 last, under the chairmanship of Mr. T. Howard Butler, was given up to the reading and discussing of two papers.

Mr. J. Bernard in his contribution "A Few Remarks on India" said that the productive activity of that country lay principally in the field of agriculture, but many of the products constitute the raw materials of manufacture in chemical and allied industries in Europe. Among the more important of these materials are cotton and cottonseed, hides and skins, ground nuts, coconuts, jute. In addition, much sugar is produced, also beer, indigo, paper, rubber, quinine, etc. Among the more important mineral products are gold, salt, nitre, iron and manganese ores, monazite and mica. A great handicap to the establishment of a sulphuric acid industry is the non-existence of deposits of native sulphur or pyrites. Owing to this fact, the acid produced in the country cannot be sold much under £14 per ton, compared with £2—£3 per ton in Britain before the war. The Indian railways will not carry sulphuric acid in carboys, therefore it has to be packed in as expensive a manner as the acid imported from overseas, *i.e.* in lead-lined cases, or stoneware jars, packed in wooden cases with whitening. In recent years the number of sulphuric acid works has increased; these are mostly quite small and erected as adjuncts to other manufactories, *e.g.* the refining of petroleum oil. They use the lead chamber process with brimstone, imported from Sicily or Japan, the cost of which compares favourably with that of pyrites; the chambers require much greater protection from the weather than is necessary in this country. Much of this acid is used for making carbon dioxide for aerated waters, the taste for which has spread tremendously among the Indians; liquefied gas from breweries is also much used for this purpose. The high price of this acid precludes the development of a superphosphate industry.

Mr. E. Walls in his paper on "Rancidity in Oils and Fats" discussed the composition, characteristics, and uses of various oils, fats and fatty acids.

MANCHESTER.

At the third meeting of the Session held on January 3, with Mr. Wm. Thomson in the chair, Prof. J. W. Hinchley gave an address on "Progress in Chemical Engineering."

Owing to national necessity and to the natural development of chemical industry, chemical engineering was now recognised as a distinct profession. A chemical engineer was to be defined as one engaged in designing or directing the use of plant for large scale operations involving physical and chemical changes. Steam boiler plants and gas producer plants, whether for power production or for chemical operations, belong to the province of the chemical rather than to that of the mechanical engineer.

Prof. Hinchley then gave illustrations of the employment of "utility formulæ," and drew attention to the usefulness of graphical methods. Very few people realised the potential value of a 6H. pencil and the degree of accuracy to which graphical methods could be carried by a good draughtsman. He also gave a description of a vacuum crystallising pan, and explained a calculation based on the use of the "utility formulæ" given by which the time of an operation could be determined. In conclusion he strongly emphasised the need for an organisation like the Chemical Engineering Group of the Society of Chemical Industry for the promotion of detailed study of the problems confronting the chemical engineer.

LONDON.

At the meeting of the London Section, held on January 6, the chairman, Dr. Charles A. Keane, reported that although up to the present the Committee had not received any suggestions from members as to the arrangements for the Annual Meeting of the Society, to be held in London in July next, it would still be pleased to do so. He also announced that in future the time of the meetings would be altered back to 8 p.m. The Chairman further called attention to the arrangements which came into force on January 1, under which the Chemical Society has generously allowed to members of certain other "contributing" societies, of which the Society of Chemical Industry is one, the use of its Library, on the same conditions as to reading and lending as to its own Fellows.

The first paper by Dr. P. E. Spielmann and Mr. H. Wood dealt with "The Estimation of Cyanogen Compounds in Concentrated Ammonia Liquor." The methods of Linder and others for use with crude gas liquor were not found suitable for the routine examination of concentrated ammonia liquor for cyanide impurities. The chief impurities are ammonium thiocyanate, ammonium cyanide and ammonium ferrocyanide, and the method adopted by the authors was to convert the cyanide and thiocyanate into the ferric salt, and to measure the depth of colour obtained by means of the Lovibond Tintometer and to compare it with that obtained with standard solutions. A method of correcting for the colour due to any ferrocyanide originally present is described in the paper.

The second paper was by Dr. Thole on "The Estimation of Benzene and Toluene in Petroleum." The simplest method is to distil the liquid up to 150° C. and fractionate the distillate. The differences between the refractive indices of the liquid before and after treatment with liquid sulphur

dioxide have also been used to estimate the amounts of benzene, toluene, etc. Chemical methods, however, are not entirely satisfactory; treatment of the petroleum, for example, with fuming sulphuric acid may also attack non-aromatic compounds, and treatment with nitrating mixture gives results which are too high. The author's process consists mainly in segregating the aromatic constituents by fractionation, the two most important points being 95° C. and 122·5° C., and after absorption by shaking with 98 per cent. sulphuric acid in a cylinder, determining the specific gravity. The percentage of aromatic hydrocarbons is calculated from the formula:—

$$\frac{\text{Initial Sp. Gr.} - \text{Final Sp. Gr.}}{\text{Sp. Gr. of Aromatic} - \text{Final Sp. Gr.}} \times 100$$

The accuracy of the results is increased by adding a correction calculated from curves giving the results of actual experiments on mixtures.

Mr. Arnold Philip described a method of determining very small quantities of water in mineral oils, which has been applied especially to so-called "Transformer" oils, used in high frequency electrical apparatus. A stream of dry air, under a reduced pressure of about 25 inches of mercury, is sucked through the sample at a rate of about 2 or 3 bubbles a second, and then passed through U-tubes surrounded by a mixture of ice and hydrochloric acid; in this way the water can be effectually removed, condensed and weighed. As the author pointed out, one great advantage of the process is that if supplied in a suitable drum, the whole sample can be treated without taking out any portion of it and when the experiment is finished the drum can be re-fastened and returned to the manufacturer with the water eliminated.

YORKSHIRE.

A meeting was held on January 13, at the Queen's Hotel, Leeds, when Dr. H. M. Dawson read a paper on "Sodammonium Sulphate—A New Fertiliser." In the absence of the chairman, Mr. F. W. Richardson, of Bradford, presided. It was intimated that the committee had passed a resolution congratulating two of the members of the Section—Prof. T. W. Cobb and Mr. W. F. Wood—upon their distinctions in connexion with the Order of the British Empire.

Dr. Dawson explained that the idea of the production of the new fertiliser, of which he was about to speak, arose out of the shortage of sulphuric acid during the war. Sodammonium sulphate, $Na_2SO_4.(NH_4)_2SO_4.4H_2O$, is formed by the interaction of Glauber's salt with ammonium sulphate at the ordinary temperature, and may be obtained by crystallisation from aqueous solutions containing the two sulphates when the temperature and the relative concentrations are appropriately adjusted.

Solutions of the two sulphates obtained by the neutralisation of nitre cake or mixtures of nitre cake and sulphuric acid may be made to yield Glauber's salt and ammonium sulphate, or may be utilised for the production of sodammonium sulphate. In the former process, the separation of Glauber's salt is effected by crystallisation at low temperature, and the mother liquor, containing ammonium sulphate in relatively large excess, is then evaporated at or about 100° C. with the deposition of ammonium sulphate crystals until the ratio of ammonium sulphate to sodium sulphate in the hot solution has fallen to about 2·7 : 1.

In the second process, the neutralised solutions, which should contain ammonium sulphate in excess of sodium sulphate, are adjusted to appropriate total salt concentration and allowed to cool to the ordinary temperature when the double salt separates out in pure condition. As described, this process involves the conversion of a mixture of nitre cake and sulphuric acid directly into the double salt, the mother liquor remaining on removal of the double salt crystals being used for dissolving further quantities of nitre cake and sulphuric acid.

The cost of fixing ammonia in this process is very much less than that in the ordinary sulphuric acid process, and preliminary trials of the use of sodammonium sulphate as an artificial manure indicate that the fertilising value of the ammonia is not impaired by the sodium sulphate present.

Discussion was taken part in by Dr. Calvert, Mr. C. P. Finn, Mr. James Ogilvie, Mr. B. A. Burrell (hon. secretary); and Professor Perkin and Mr. Hatley spoke to a vote of thanks.

Dr. Dawson, in reply to some of the comments made, said he recognised that the commercial possibilities of sodammonium sulphate would depend upon the price of sulphuric acid and nitre cake. This was where the effect of many vested interests might operate. He added that trial experiments on a small scale at Garforth had been quite satisfactory.

MEETINGS OF OTHER SOCIETIES.

ROYAL INSTITUTION.

The first Friday Discourse was given on January 17 by Sir James Dewar on "Liquid Oxygen and the War," the Duke of Northumberland presiding.

The lecturer first recalled the fact that at the outbreak of hostilities the Royal Institution had proffered its assistance to H.M. Government by undertaking chemical and physical researches that might help in the conduct of the war. He then drew attention to the address he gave before the British Association in 1902, in which he compared and contrasted the facilities for higher scientific teaching and research in this country with those obtaining in Germany; then as now, want of education was the root cause of many of our difficulties. The prognostications made in that speech had been fully justified by recent events.

Coming to the immediate theme of the lecture, Prof. Dewar referred to the disappearance of the barium oxide process of manufacturing oxygen, and its replacement by that involving the fractionation of liquid air. For a time there was no demand for the nitrogen thus liberated, but now it found extensive application in the manufacture of nitric acids and nitrates, of cyanamide, and of ammonia by the Haber process. The German dye manufacturers had exploited the electrical method of fixation and had invested some £3,000,000 in acquiring cheap water-power in Sweden. So much importance was attached to the Haber process in Germany that it had been made a national monopoly, and, in effect, it had been the principal means of enabling that country to satisfy its requirements of explosives during the war. For the Haber process the hydrogen was obtained electrolytically and by freeing water gas from admixed gases with the aid of low temperatures. In this country the total output of the 12 factories manufacturing liquid oxygen was 1 million cub. ft., say 118 tons per day, 85 per cent. of which was used for cutting and welding metals and 15 per cent. for medical purposes: in Germany one plant alone was turning out 100 tons per day.

Liquid oxygen was now much used by airmen flying at high altitudes. For this purpose it is stored in vacuum vessels provided with a mechanism for controlling the evaporation, and with tubes leading to a mouth-piece for the aviator to inhale through. There are three types of mechanism.

In the first, the liquid is heated electrically; in the second, the evaporation is promoted and controlled by thermal conduction through a rod of copper or aluminium in the liquefied gas; in the third the liquid is siphoned out into an evaporating chamber, from which the gas is conducted through tubes—to bring it to air-temperature—to the airman's mouth, the rate of evaporation being controlled by adjusting the conical stop-cock through which the gas is passed.

Liquid air is stored in spherical metallic vacuum vessels holding from 5 to 30 gallons, the high vacuum required being maintained by keeping absorbent charcoal, cooled to the temperature of the liquefied gas, in a chamber attached to the lowest part of the external wall of the inner vessel, whereby the annular space is very highly exhausted. These vessels are very durable, and the rate of loss of material from the largest of them does not exceed 5 per cent. per day.

The lecture was illustrated by numerous experiments, among the most remarkable of which were the demonstration of the magnetic property of liquid oxygen by placing an electro-magnet near drops of it falling from a pipette, these being drawn to the pole in the form of a thin stream: and the stopping of the motion of a radiometer wheel by creating a vacuum around it with liquid air and charcoal, the pressure being reduced to about $\frac{1}{50}$ millionth of an atmosphere.

Speaking of the Royal Institution, Sir J. Dewar said that a few years before the war Prof. Haber had paid it a visit with the object of studying the best means of establishing similar institutions in Germany, as there it was felt that many of the research workers were too much dominated by manufacturing and academic influences. Since then five or six Kaiser Wilhelm Institutes had been founded on the model of the Royal Institution. The latter had always been conducted on individualistic lines, being maintained by the members, and at an average cost of not more than £1200 per annum during the first 100 years; he feared for its security now that State interference was the order of the day. Although the endowments had increased six-fold during his tenure of office, there had been a very serious fall in the membership during the war, and he hoped that both increased endowments and a large influx of new members would be forthcoming to enable the Institute to carry on its work to the fullest advantage.

INSTITUTION OF PETROLEUM TECHNOLOGISTS.

At the meeting held on January 21, a paper was read by Messrs. A. Campbell and W. J. Wilson on "Paraffin Wax and its Manufacture."

In this paper the authors gave a general historical account of the discovery, constitution and uses of paraffin wax, and then dealt with the process of manufacture and its development from the early stages (prior to the original patent of John Hodges in 1871 in which the present methods of "Sweating" had their birth) down to the efficient process in use at the present day, in which the wax is handled with a minimum amount of labour as compared with the large amount necessary when the old system of cake sweating was in vogue.

Paraffin wax does not assume the crystalline form, which ensures its easy separation from the accompanying oil, until after distillation, when the crystalline paraffin comes over in the distillates after the kerosene, the lower melting wax coming over with the lower distillates, and the higher melting wax coming over at the end of the distillation. The crude scale is separated from these paraffinoid fractions by means of filter presses working at definite temperatures, the operation usually being carried out in two stages, one much cooler than the other: a scale of higher melting point being obtained from the higher temperature pressing, than in the lower.

On the question of the sweating of these two separate fractions, the authors gave a detailed account of experiments performed both in sweating the two fractions separately and in sweating them when mixed in the proportions obtained. The main result of the investigation was that sweating of the total scale produced a much greater yield of white paraffin in less time than the treatment of the hard and soft scales separately.

Corrigendum.—British Association of Chemists, p. 474 R (1918), line 37 from top: for "Institute" read "National Union of Scientific Workers."

PERSONALIA.

Dr. F. L. Pyman, at present Director of the Wellcome Chemical Research Laboratories, has been appointed Professor of Technological Chemistry in the Manchester Municipal College of Technology, and in the University of Manchester.

Dr. O. E. Mott, O.B.E., Chief Chemist at H.M. Factory, Site "B," Oldbury, will shortly join the research staff of Boot's Pure Drug Co., Ltd., as head of the Technical Research Laboratory.

Dr. E. K. Muspratt has been appointed Hon. President of the United Alkali Co., Ltd., on the occasion of his retirement from active participation in its affairs.

The death is announced of Captain A. Gemmell from the effects of lethal gases. Captain Gemmell was an analytical chemist by profession. In 1917 he entered the Anti-gas Department of the Royal Engineers, and undertook research work on poison gases under the late Col. E. F. Harrison, who died from a similar cause.

Messrs. W. G. Gardiner and F. C. Gardiner, Glasgow shipowners, have presented £60,000 to the University of Glasgow for the foundation of professorships in organic chemistry, physiological chemistry, and in bacteriology. The stipend attached to each post is £1000 per annum.

Among the recent recipients of the Order of the British Empire were: *Commanders* (C.B.E.), Mr. G. C. Clayton, director of the United Alkali Co., and Mr. W. F. J. Wood, President of the Society of Glass Technology, chairman and managing director of the Derby Crown Glass Co., etc. *Members* (M.B.E.), Dr. A. Rule, late superintendent H.M. Wood Distillation Factories, Ministry of Munitions, and Mr. A. Stevenson, Chief Chemical and Technical Assistant in the Optical Munitions Department, Ministry of Munitions.

A letter signed by the President and the Registrar of the Institute of Chemistry has been addressed to Mr. K. B. Quinan, of the Ministry of Munitions (Department of Explosives Supplies), thanking him for the valuable services he has rendered to the Empire and the Allies during the war, and not least for the excellent technical training which he initiated for chemists engaged under the Department. In his reply, Mr. Quinan records his deep appreciation of the unswerving loyalty and support he has always received from chemists and other scientific men, and states his conviction that the past four years have completely altered the position of the chemist in Great Britain. He predicts that manufacturers will now see the urgency of the need for highly trained chemical supervision of manufacture, and also that the chemists and the teaching institutions will view their obligations to industry in an entirely new light.

NEWS AND NOTES.

CANADA.

A Rich Asbestos Find.—A rich asbestos deposit has been discovered at Lake Frontier, Montmagny County, in the Province of Quebec. Asbestos recently reached record figures both in value and tonnage, the average price per ton being $52·45 against $38·87 in the previous year. The total quantity of asbestos-bearing rock mined and hoisted was 2,634,410 tons. The value of asbestos extracted from it, counting stocks on hand at the end of the year, was $8,120,409. This represents a value of $3·08 of asbestos extracted from each ton of rock.—(*Official.*)

Standardising Dairy Products.—At a recent session of the Dominion Dairy Conference held in Ottawa, the Canadian Dairy Commissioner announced the intention of the Federal Department of Agriculture to organise a Dairy Research Division, which should investigate the scientific problems constantly arising in the manufacture of dairy products. It was decided that the Council should be composed of two representatives from each province of the Dominion, with power to add to its number.

Lignite in Western Canada.—The Lignite Utilisation Board of Canada recently issued a bulletin giving some details concerning its work for the information of those who may become interested in a business way in the project. The Board was created by an Order-in-Council of the Dominion of Canada, and by supplementary agreement $400,000 was appropriated for its use. The Order sets forth the reasons for the creation of the Board: "That there are large deposits of lignite underlying various districts of the Provinces of Saskatchewan and Alberta, some of which, in the raw state, can only be utilised when freshly mined, and are, moreover, unsuited in such state to household use; that by carbonising this lignite, a coke or charcoal is obtained which briquettes readily and, without consideration of the by-products such as oil, pitch, ammonia sulphate, gas, etc., the result is to turn two tons of inferior fuel into one ton of briquettes approximating, in heating value, anthracite coal with practically the same heating value in the domestic furnace as the two tons from which it was made."

At the present time two engineers in the employ of the Utilisation Board are investigating every plant, method and type of machinery in the United States and Canada which have to do with binders, carbonisers, briquetting and heat treatment of coals. The plant is to be constructed in southern Saskatchewan, of a capacity of not less than ten tons per hour, and it is expected that by the spring of 1920 the new demonstration plant will be in full operation, and that a successful outcome will result in the establishing of an industry of national importance.

Shipment of Wheat from Vancouver to Great Britain. A bulletin prepared by F. J. Birchard and A. W. Alcock has been recently issued from the Department of Trade and Commerce, Ottawa, recording the experimental work undertaken by the Department of Trade and Commerce through the agency of its Grain Research Laboratory to determine the feasibility of shipping grain from Vancouver *via* the Panama Canal to the United Kingdom. All the grain was carefully selected and examined previous to shipment, and a representative of the Laboratory accompanied the shipment in order to make the necessary observations *en route*. The grain used and the arrangement of the cargo are described, and the placing of the electric resistance thermometers in the grain is outlined and illustrated by the use of numerous diagrams. The data obtained are tabulated, and it is concluded that if sound grain containing probably not more than 14·5 per cent. water is kept free from water, and the portions near the stokehold kept cool by ventilation, the cargo will probably arrive at its destination in good condition. It is recommended that further trials be made.

SOUTH AFRICA.

Industrial Developments, etc.—The manufacture of fertilisers has been commenced at Parow, Cape Province.

A Johannesburg company proposes to establish a factory in Pretoria for the manufacture of starch, glucose, sago and tapioca. If sufficient raw material can be obtained, the factory is expected to be in a position to manufacture the whole of the South African requirements of these commodities.

According to an Imperial Institute report, sugar-cane wax (which is now being produced at Durban) appears to be quite suitable for the purpose of coating cardboard containers for jam, syrup and other semi-fluid products.

At the annual congress of the Transvaal Agricultural Union, a resolution was passed urging the Government to provide for the erection of an oil-expressing factory, and to institute inquiries concerning the profitable cultivation of oil-bearing seeds and plants in the Transvaal.

A preliminary report issued by the Director of Census, embodying the principal results of the Census of Factories and Productive Industries in the Union for 1916-17, states that the total number of factories engaged in the chemical and allied industries (fertilisers, by-products, paints, varnishes, etc.) was 90. Of these, 37 were situated in the Cape, 21 in Natal, 31 in the Transvaal and 1 in the Orange Free State.

According to an American paper, a representative of the Walmer Papyrus Pulp Company, Ltd., has been visiting the United States with a view to securing machinery for a mill which he proposes to erect in the St. Lucia district of Zululand for the purpose of dealing with the large quantities of papyrus growing in that area. The machinery, which is now ready for shipment to South Africa, will be capable of turning out 20 tons of pulp a day. It is not proposed to undertake the manufacture of paper, but simply the pulp or "half-stuff," which will be exported. The company hopes to begin turning out pulp by March or April, 1919.—(*S. Afr. J. Ind., Sept.,* 1918.)

AUSTRALIA.

Tinplate Manufacture.—Mr. Watt, acting Prime Minister, expects shortly to announce the establishment of the manufacture of tinplate in Australia; hitherto the country has been dependent on overseas supplies.—(*Official.*)

Australian Zinc and Subsidiary Industries.—A review of the development of the zinc and related industries has recently been communicated to the acting Prime Minister of the Commonwealth by the Electrolytic Zinc Company of Australasia, Ltd. Following on the rapid progress of electrolytic zinc processes in Canada and the United States, the Amalgamated Zinc, Ltd., turned its attention to the establishment of this industry in Australia, where in pre-war days zinc concentrates equivalent to 200,000 tons of spelter were exported annually. The Zinc Corporation, Ltd., joined the project later and the Electrolytic Zinc Company of Australasia, Ltd., was formed. Operations were started in January, 1917, at Risdon, near Hobart, Tasmania, where hydro-electric power was available. Production commenced in March and an output of 25,000 lb. per day has now been reached. The product has a purity exceeding 99·9 per cent. and is suitable for all classes of high grade work.

The zinc concentrates are being de-sulphurised at Broken Hill and sulphuric acid to the extent of 100 tons weekly is being obtained by this means. The calcined ore is then shipped direct to Tasmania and the ships are loaded back with Tasmanian timber, thus affording assistance to the latter industry which is now supplying 250,000 super. feet per month to the Port Pirie smelters and to the Broken Hill mines. Over £300,000 has already been spent by the Electrolytic Zinc Company and further large expenditure is anticipated in order to establish the production of other zinc derivatives—lithopone, zinc oxide, alloys and salts. As soon as additional supplies of electric power become available it is proposed to undertake other electro-chemical processes, such as the production of aluminium, caustic soda, chlorine and bleaching powder.—(*Bd. of Trade J., Jan.* 9, 1919.)

JAPAN.

The Chemical Industry Exhibition.—The Chemical Industry Association has decided to hold the second exhibition in Uyeno Park, Tokyo, in 1921, during the ten weeks beginning March 16. Mr. K. Uchida, late vice-minister of the Department of Communications and actual president of the Association, has left for the United States to make arrangements for the participation of American manufacturers. Among the exhibits will be raw materials from China, Siberia and other Eastern countries.

The Japanese Potato Starch Industry.—Last year the export trade in Japanese farina or potato-starch was very brisk, and farmers were encouraged to increase the area of land under potatoes. There are now over 200,000 acres under cultivation. In 1917 about 80,000 tons of starch was exported, and the production for the present year, although reduced somewhat by the outbreak of potato disease, is expected to reach 100,000 tons. Export prospects are far from bright owing to freight difficulties and to the prohibition of imports to both Great Britain and United States. As, however, prices continue firm, it is suspected that certain speculative transactions are holding up the market.—(*U.S. Com. Rep., Nov.* 1, 1918.)

Potassium Chlorate Industry in Japan. Potassium chlorate was first made in Japan in 1908, but it was not till 1912 that any considerable quantity appeared on the market. During the war, the increase in prices stimulated the production very greatly, but overproduction, high freights and shipping difficulties are now causing considerable depression. The trade now depends chiefly upon exports to the United States and to South America.

At the end of 1917, there were 49 factories engaged in the manufacture, the capital represented being 6,000,000 yen. The total capacity amounted to 10,000 tons a year but the production was only 6000 tons, 60 per cent. of which was made by 3 factories. The average domestic consumption of the product is about 3700 tons. Prices are still high, £5 per barrel being quoted in October last, as against 25s. before the war (see also this J., 1918, 320 R).—(*Bd. of Trade J., Jan.* 9, 1919.)

UNITED STATES.

Output of Manganese Ore.—According to reports received by the Geological Survey, a great increase in the output of domestic manganese ore has recently been effected. Whereas in 1917 only one-sixth of the home requirements of high grade ore was produced, the supply now amounts to nearly one-third. The shipments of ore containing above 35 per cent. of manganese were 136,551 tons during the first six months of 1918, and the total for the year will probably be about 324,000 tons. The shipments of ore containing 10—35 per cent. metal are estimated at 832,868 tons for the whole year.

Sterilisation by Pressure.—Prof. B. H. Hite has experimented on the influence of high pressures upon bacteria and has found that even a momentary pressure of two hundred atmospheres will kill them. There is a possible large scale application of his work to the sterilisation of milk etc., where under present methods the taste is affected and chemical changes are liable to occur.

Proposed New Chemical Museum.—The possibility of establishing a chemical museum of a new sort has recently been discussed. When the war shut out many organic chemicals needed for research, those engaged in making them were handicapped through the lack of type samples for study and comparison. It is suggested that a reasonable quantity of every chemical obtainable be filed with data, and that as new compounds are discovered they be added to the collection. We would have, therefore, a materialistic Beilstein which could always be drawn upon as needed. Those interested in the plan fully realise the difficulty of keeping some compounds, and our lack of knowledge regarding the ultimate decomposition and rate of decomposition of many of them. A number of isolated and very incomplete collections already exist.

GENERAL.

The Government Dye Scheme.—In accordance with the provisions of the memorandum relating to the Government scheme for assisting the dye industry, the Board of Trade has appointed the following as members of the Trade and Licensing Committee:—Lord Colwyn, chairman; Messrs. H. Allen, Milton S. Sharp, and Lennox B. Lee, nominated by the Colour Users' Committee; Mr. T. Taylor, nominated by the National Federation of Associations of Paint, Colour and Varnish Manufacturers; Mr. J. Turner and Dr. H. Levinstein, nominated jointly by British Dyes, Ltd., and Levinstein, Ltd.; Mr. W. J. U. Woolcock, nominated by the Association of British Chemical Manufacturers; Mr. W. H. Dawson, nominated by the President of the Board of Trade. The secretary of the Committee is Mr. W. Graham, of the Board of Trade (7, Whitehall Gardens, S.W. 1), to whom all communications should be addressed. The functions of the above Committee were set out in our issue of November 30 last, p. 429 R.

Chemists: Pivotal Men.—With regard to the release of pivotal men from the forces for employment as chemists, the Demobilisation and Resettlement Department of the Ministry of Labour has authorised the Institute of Chemistry to assist in the selection of names of chemists (professional consulting, analytical and research) whose prompt return to civil life will prove of the most value to the country for the purposes of reconstruction and absorption of unemployed labour. The Institute is asked to select officers and men who can be classed as pivotal, preference being given to those with the longest service and to married over single men. Works chemists are not to be included in the selection, as their employers are required to apply for them under the industry in which they are engaged. The names of selected men will be forwarded by the Registrar of the Institute to the Department of Demobilisation.

Scientific Research Association.—In order that the interests of pure science may not be lost sight of amongst the increased activities of applied science which have resulted from the war, the formation of an Association having the above title has been proposed. Many eminent men of science have notified their adherence to the proposal the aims of which are defined as follows:—(1) To be prepared to offer advice and information to those who wish to

devote themselves to scientific research. (2) To be prepared to give advice to bodies administering public funds for research as to the most useful ways in which such funds could be applied. (3) To impress upon the attention of the public the importance of scientific research, and thus to promote a wider understanding of the fundamental value of scientific method. (4) To consider the possibility of organising a scheme of permanent national endowment so as to afford opportunities for young and promising students to establish themselves in research work, and to secure to the ablest of these the possibility of a career devoted mainly to the continued pursuit of scientific investigation. By keeping in touch with all workers in science the Association hopes to be able to render collaboration easier and to avoid unnecessary duplication of work. All persons over 21 years of age who have published research or who are engaged in research for publication are to be eligible for membership, and all others who are interested are also to be eligible as associate members.

The Association is to be governed by a President and Council, and Subject, General Purposes and Propaganda Committees are to be formed. The promotors disclaim the idea of interference with any existing body, or that the activities of the proposed organisation are to be limited to Cambridge although the first steps were taken there. Copies of literature on the subject and forms of application for membership may be obtained from Mr. A. G. Tansley, Acting Secretary, Grantchester, Cambridge.

Indian Indigo Crop Forecast, 1918-19.—The Director of Statistics, in a forecast issued on October 17, 1918, estimates the total area sown with indigo in British India at 280,500 acres, a decrease of 55 per cent. on the revised estimate of last year. The total yield of dye is now roughly estimated at 32,100 cwts., as compared with 87,800 cwts. forecasted last year. Weather conditions at sowing time were unsuitable owing to deficient rainfall, and the condition of the crop, on the whole, is only fair.—(*Bd. of Trade J., Jan.* 9, 1919.)

Indian Industries during the War.—In a statement submitted to the Imperial Legislative Council by the Hon. Sir G. Barnes, it is recorded that with the co-operation of the Government a number of new industries have been started during the war. These include, caustic soda, magnesium chloride, thymol, sandalwood oil, copperas, zinc chloride and refined nitre. Ferro-manganese is being produced in large quantities and has even been exported. The manufacture of micanite has been taken in hand by a private firm and by the East Indian Railway. The production of silica bricks for lining furnaces has progressed so far that India will soon be independent of foreign supplies. There has been an immense increase in the output of industries which were already established before the war, *e.g.*, the output of steel ingots by Messrs. Tata Sons and Co. has doubled since 1913, and excellent progress has been made in the glass and coir industries, and in the exploitation of indigenous tanning materials. The expansion in output of the Ordnance Factories, since the Munitions Board assumed control in January 1918, has been very great, and a large scheme for extension is now being carried out at a cost of about £500,000. This, with the new acetone factory at Nasik, will render the country less dependent on outside supplies of military stores. The extension of the works of the Tata Iron and Steel Co. at Sakchi has increased the annual steel capacity to 200,000 tons. Considerable success has attended the special attention given to the manufacture of anti-friction metal, ferro-manganese, glass, pottery, refractory bricks, disinfecting fluids, asbestos boiler composition, glucose, coir articles, and graphite crucibles; and plans are already advanced for the establishment of the following new industries:—Distillation of coal tar, manufacture of galvanised sheets and tin plates, refining of copper and zinc, construction of electric furnaces for making steel castings and ferro-alloys, and various engineering enterprises.—(*Bd. of Trade J., Jan.* 2, 1919.)

Mineral Wealth of Finland.—Very important discoveries of iron ore have been notified in Jussarö and on the northern Ladoga lake near Pitkäranta. In the latter district mining was already in progress in 1820, but after many ups and downs was abandoned in 1904. During that period about 250,000 metric tons of iron ore was mined, in addition to some silver, copper and tin. The presence of ores of molybdenum, bismuth and tungsten was also proved. In other parts of Finland there are deposits of limonite, 60,000 tons of which was mined in 1891. Large copper deposits occur in Orijärvi as well as in Lappland, where they have never been worked. Finland is also very rich in first quality building stones, particularly in granite, and these occur near the sea. The clay and limestone deposits should be of great value to the cement industry, which is yet in its infancy; and the large areas of peat should in the future acquire great industrial importance.—(*Z. angew. Chem., Nov.* 22, 1918.)

Reconstruction of French Iron and Steel Industry.—A new company called "La Société Corporative des Mines de Fer et de la Siderurgie des Régions Sinistrées" has been formed in France. The capital amounting to 1,000,000 francs is held by the chief iron and steel companies of the invaded regions. The company is affiliated with the "Comptoir Central d'Achats Industriels pour les Régions Envahies" to which it acts as a technical commission. The Société is collecting all the detailed information necessary for compiling estimates of the material and plant required for the restoration of the damaged mines and steel works. From these estimates a programme of reconstruction will be drawn up and handed over to the Comptoir Central for execution. Some idea of the magnitude of the undertaking can be gathered from the fact that before the war the invaded provinces accounted for 90 per cent. of the French iron ore ouput, 86 per cent. of the pig iron and 74 per cent. of the steel production. The 1913 figures for total French outputs were:—Iron ore, 21,714,000 tons; pig iron, 5,300,000 tons; steel ingots, 4,600,000 tons. It is expected that a large amount of equipment for the mines and furnaces will be obtained from the United States.—(*U.S. Com. Rep., Nov.* 13, 1918, *and Bd. of Trade J., Dec.* 19, 1918.)

The German Iron Industry.—Notwithstanding the secrecy with which all production figures are now kept, it is quite certain that the German iron production has fallen off considerably during the war. The annual outputs are given as follows (in metric tons):—1913, 19,310,000; 1914, 14,383,000; 1915, 11,785,000; 1916, 13,150,000; and 1917, 11,000,000. The last figure is an estimate and is thought to be far too high.

The Government is encouraging the continuance of the Steel Syndicates, such as the Stahlwerks-Verband, as being the best protection for the industry during the transition period. Germany fears that France may refuse to sell iron ore from the Longwy and Briey basins, in which case German reserves of iron ore will only last about 60 years at the present rate of output of the steel works. No official figures are available for the home prices but the following were in force in October, 1917:—Bar iron 235 marks per ton, sheets 295 marks, and girders 250 marks. The prices for export were considerably higher and at the end of 1917 were about four times the above figures.

The object has apparently been to keep the export prices just below the Swedish prices and neutrals have been forced to pay these high figures for their essential requirements. Exports, however, have been below normal, and were completely stopped from September, 1916, till April, 1917 During the present year Denmark continues to receive fairly big consignments of ordinary commercial sorts, but practically no shipbuilding materials have been supplied, this being in conformity with Germany's policy to keep the tonnage at the disposal of neutral countries as small as possible.—(*U.S. Com. Rep., Nov.* 12, 1918.)

Chemical Industries in Sweden.—The new rubber factory in Landskrona is to restart operations at the end of 1918. The factory and plant are valued at 300,000 kroner (about £17,000). It is intended, in the first place, to concentrate on the manufacture of "war rubber," for which the demand is very great. The patent to be worked is a Danish one, the Swedish rights of which have been acquired by a syndicate in Stockholm.

The "Elektrolys" company of Stockholm is to manufacture hydrogen peroxide, which is in very short supply in Sweden.

During the years 1914—16 the greatest advances were made in the manufacture of aluminium compounds, caustic soda and bleaching powder, the output of these materials being (in metric tons):—in 1914, 5858, 179 and 426, respectively; in 1916, 17,574, 613 and 1546, respectively. Considerable progress was also made in the production of ammonium compounds (except ammonium sulphate), green vitriol, calcium carbide, caustic potash, chlorate, blue vitriol, sodium sulphate and hydrochloric acid. Among new manufactures were potassium nitrate, nitrobenzene, silicium carbide and trinitrotoluene. On the other hand the production of the following decreased, or in some cases was temporarily abandoned:—Potassium ferricyanide, phosphoric acid, gypsum, washing soda, sodium bisulphate, nitric acid and sulphuric acid.—(*Z. angew. Chem., Nov.* 22, 1918.)

The Swedish Cellulose Industry.—Although the mechanical wood pulp process was working some 13 years before the chemical processes were started, the latter have far outstripped the former, as is shown by comparing the outputs; in 1892 the quantities produced were 40,000 tons of chemical pulp and 46,000 tons of mechanical pulp, whereas in 1915 the figures were 910,000 tons and 306,000 tons respectively. Both the sulphite and sulphate chemical processes are in operation, but the sulphite is predominating. The spirit which forms a by-product of the latter process is becoming an important item. It is estimated that shortly, when a number of new plants are working, an aggregate production of 4,000,000 gallons per annum will be reached, a considerable quantity when compared with the normal benzine import of 5,600,000 galls. Sweden is the largest exporter of cellulose in the world; the total amount exported in 1915 was 722,000 tons, valued at over £5,000,000, of which about one-half was delivered to England.—(*U.S. Com. Rep., Oct.* 24, 1918.)

Chemical Industries in Norway.—Prof. N. Lindeman has recently published the following information concerning the Norwegian chemical industries:—When the big works at Aura and Bjolvefossen reach the production stage, the total potential annual output of cyanamide will reach 7—800,000 metric tons. According to Birkeland and Eyde, 100—120,000 tons of nitric acid could be produced yearly at "Norsk Hydros" in Telemark, but the actual output in 1916 did not exceed 4000 tons as most of it was fixed with lime, soda, or ammonia. Only 46,000 tons of Norwegian saltpetre was exported in 1916, as against 70,000 tons before the war. Norway has become independent of foreign supplies of phosphorus; all she needs for her match industry (the output of which was valued at 4·4 million kroner in 1915) is made in two factories by the electric furnace method. There is one factory producing zinc white and white lead, of which no less than 2400 tons was imported in 1916, and a new establishment is now making titanium white from indigenous materials. A single factory is producing, from native material, sufficient aluminium sulphate to meet the country's requirements (about 3000 tons in 1916). Factories in Frederikstad and Vadeim are turning out metallic sodium; they exported 600 tons of the metal, and also 280 tons of potassium chlorate, in 1916. There are eight factories making ferrosilicon, of which 25,000 tons was exported in 1916, while the whole production in 1911 was only 5700 tons. The exports of ferro-chrome fell from 33,000 tons in 1915 to 2900 tons in 1916. The smelting of aluminium is an industry of great importance. Of the four factories, the largest, in Hölvaag, will shortly start working, and all of them use, or will use, imported raw materials. Copper and nickel are produced electrolytically in Kristiansands; 700 tons of nickel was exported in 1916. Tin is recovered from scrap in Stavanger. Norway's dependence upon foreign countries for electrodes is diminishing; only 300 tons was imported in 1916. The estimated value of the Norwegian electrochemical products was 89 million kr. in 1911, 134 million in 1913, and 368 million in 1916 (krone = 1s. 1½d.).—(*Z. angew. Chem., Nov.* 1, 1918.)

Salt, Bromine and Calcium Chloride in the U.S.A.—The supplies of salt in the United States are more than sufficient to meet the requirements. In 1917 these amounted to seven million short tons, valued at £4,000,000, an increase of 10 per cent. in quantity and 46 per cent. in value over the previous year. The higher cost was largely due to higher wages and dearer fuel. The relative proportions of the different grades of salt produced in 1917 were: Rock salt, 1,605,025 short tons, mined by 18 firms in 8 States, chiefly in New York and Kansas; brine salt 5,373,152 tons, chiefly from Michigan, New York, Kansas and California. Of the brine salt, 688,022 tons were for table and dairy use, 1,542,087 tons common packer's salt, both fine and coarse, 159,361 tons coarse, solar evaporated salt, 93,094 tons pressed blocks, etc., and 2,890,588 tons were sold for brine. The quantity of brine used by chemical works shows an increase. Three million tons of brine salt was used in the manufacture of salt-cake, soda ash, caustic soda, sodium bicarbonate, carbonate, acetate, chlorate, phosphate and silicate, Glauber's salt, calcium chloride, chlorine and hydrochloric acid. The consumption of domestic salt averaged 140 lb. per head in 1917. About 66,000 tons of salt were imported into the United States in 1917, about half of this being from the British West Indies and one-quarter of it from England. Most of the imported salt is coarse, solar evaporated salt used for curing fish and meat. About 114,000 tons of salt were imported in 1917, more than 90 per cent. of it going to Canada, Cuba and Mexico. A great increase occurred in the amounts exported to Newfoundland, Labrador, Jamaica, Dominica and other West Indies. A considerable quantity is also exported to Japan, Australia and New Zealand.

About 450 short tons of bromine with a value of £100,000 was derived in 1917 from the bittern left after extracting the salt from the brine wells of Michigan, Ohio and West Virginia. The production was retarded by steadily increased costs.

Three processes are employed for extracting bromine: (i) The intermittent process in which the bittern is concentrated to a sp. gr. 1·37—1·4 Bé,

and is then distilled with sodium chlorate and sulphuric acid in sandstone stills holding 400 to 1200 gallons, a jet of steam being used as the heating agent. The resulting gas is freed from chlorine by passing it through washers containing milk of lime, and the bromine is condensed and collected in glass or stoneware receptacles.

(ii) The "continuous process" in which chlorine gas is passed through bromine-bearing brine, the bromine liberated being then removed by a current of air and passed over iron filings to convert it into ferric bromide. This is dissolved in water and treated with sodium, potassium or ammonium hydroxide, the ferric hydroxide is separated and the solution evaporated until the bromide crystallises out.

(iii) The electrolytic process, in which the brine is subjected in wooden tanks to a current of 4 to 5 volts applied through carbon electrodes. The electrolysed liquor trickles down a lattice work and the bromine is removed by a counter-current of air which is then passed through water and the resulting solution is converted into ferric bromide.

About 30,000 short tons of calcium chloride with a value of £90,000 were made from brine in 1917 in Michigan, Ohio, West Virginia and California; an increase of 10 per cent. over 1916. This is in addition to the large quantities obtained as a by-product in the ammonia-soda process in New York, Michigan, Ohio, Kansas and Virginia. Calcium chloride in solution is largely used as the circulating fluid in refrigerating apparatus, in the water-jackets of motor cars, in automatic sprinklers and in fire-buckets. In the solid state, it is used for laying dust, drying gases, vegetables and fruit and in dehydrating organic liquids. When prepared from brine, the bittern is heated, treated with milk of lime and the clear liquid is decanted and evaporated until all the salt crystallises out. The liquid is then evaporated to dryness and the residue is run into metal drums where it solidifies.—(*U.S. Geol. Surv., Aug.*, 1918.)

Casein in Soap.—Casein is recommended for use in the manufacture of toilet soaps owing to its favourable action on the skin, although it does not appreciably add to the detergent power of soap. It is soluble in alkaline lyes, and in hot process soaps is incorporated as follows:—In a steam-jacketed vessel 25 kilos. of casein is covered with an equal weight of cold water, and allowed to soak. A solution containing 1 kilo. borax in 50 litres of water is then added, and the whole heated and stirred. As soon as the casein is dissolved, 1 kilo. of 30—33° Be. soda lyes made up to several litres in boiling water is added, and heating continued without bringing the mass to boiling point. The paste thus obtained is thoroughly incorporated with the hot soap before it goes to the frames. The soap is really a "milk soap" and on this account is recommended for the toilet. The exact quantity of casein required for one operation should only be prepared at a time, as it does not keep in a moist condition; antiseptic essences such as cloves, cinnamon, citronella, however, help to preserve it. In the case of soap powders, the casein in powdered form is mixed with the dried soap chips before they are ground, forming a homogeneous mass which is easy to work. It should not be used with neutral soaps or soaps slightly acid as it provokes rancidity and tends to deteriorate. It has soothing properties, gives an agreeable texture to the soap, often improves the bad odour of fat, and in ordinary times is cheaper than fat.—(*Parfumerie Moderne, Sept.*, 1918.)

Nationalisation of Lignite Mines in Greece.—The lignite mines at Florina are to become State property. This is the first step towards the acquisition by the State of all the mines in Greece.—(*Messager d'Athènes, Sept.* 19, 1918.)

Superphosphate Manufacture in Russia.—The Russian Department of Industry has planned the erection of a superphosphate factory to be associated with the State chemical factories in the Volga and Kama district. For this purpose the Soviet for Industrial Affairs has passed a credit of 2 million roubles.—(*Z. angew. Chem., Nov.* 22, 1918.)

Radium Ore in Devonshire.—A correspondent to *The Times* (January 18) states that an important discovery of pitchblende has been made on the Kingswood estate, Buckfastleigh, Devon, by the present landowner, Mr. F. Sykes. Analysis of a representative sample by Dr. H. Terry, of University College, London, shows a uranium oxide content of over 26 per cent. Preparations are being made for working the lode on a large scale.

LEGAL INTELLIGENCE.

Supply of Road-spraying Material. *Bristowe and Co., Ltd., and Abbott and Co.* v. *The Gas Light and Coke Company.*

In the King's Bench Division, on November 28 last, Lord Coleridge heard consolidated actions, in which the plaintiffs claimed damages in respect of loss or damage occasioned through the supply by the defendants from their Beckton Works of a barrel of cyanogen gas liquor as one of a lot of 32 barrels of "Tarvia," which is a preparation of tar used for road dressing. In the course of road dressing operations at Wanstead, the plaintiffs' workmen were emptying the barrels of "Tarvia," as required, into a boiler in which it was heated preparatory to spraying on the road surface. When the barrel, which was found by subsequent analysis to contain cyanogen gas liquor instead of "Tarvia," was emptied into the boiler, in which there was already hot "Tarvia," the latter was caused by the violent generation of steam to froth over from the boiler. The overflowing "Tarvia" caught fire from the fire-box beneath, and a trolley, horse and other property were burnt by it.

The defendants pleaded that the barrel containing the gas liquor had not been supplied from their works, and that, if it had, the plaintiffs should have discovered the mistake, as the barrel was coloured and marked differently from the barrels containing "Tarvia."

His Lordship, after hearing evidence, found for the plaintiffs, and awarded them £166 as damages.

Phosphate Contracts with Enemy Subjects. *D. T. Boyd and W. A. Pratt* v. *Beer, Sondheimer and Co. D. T. Boyd and Co.* v. *Chemische Fabrik "Honnigen" and its Successor, Chemische Fabrik "Rhenania."*

On December 18 last, the plaintiffs brought an action in the King's Bench Division against the defendant company of Frankfort, Germany, claiming declarations that a contract made in May, 1914, for the sale of a total of 18,700 tons of Florida phosphate, to be shipped in the autumn of 1915 and in succeeding years up to 1920 to Bremerhaven, was dissolved by reason of the outbreak of war between England and Germany. The case was brought under the Legal Proceedings Against Enemies Act, 1915.

Mr. Pratt said that if he had had to carry out this contract he could not have supplied the Government as he had done during the war. If they had to deliver within six months after the war they would have the greatest difficulty in finding the necessary freight room; freights had risen from 14*s.*—15*s.* to £7—£8 per ton, and the American railroads had put up their rates.

Mr. Justice Bray said it would be against public policy for the plaintiffs to have this contract hanging over their heads, as the Germans could use

such contracts to their advantage by denuding themselves of their phosphates, knowing that they had got this contract still in existence. This case was completely covered by the Rio Tinto case (this J., 1918, 77 R), where it was decided that the contract could not be split in two, one to apply during the war and one afterwards. The defendant company maintained that by German law the parties were bound to go to arbitration, but he had no reason to suppose that such a law existed. The plaintiffs were entitled to the declarations, but there would be no order for costs.

The second case, involving the supply of 3000 tons of phosphate rock, was similar to the above, and was undefended. His Lordship granted the declarations asked for.

Borax Contracts with Enemy Subjects. *Borax Consolidated, Ltd. v. Vogel and Others.*

In the King's Bench Division, on January 15, Mr. Justice Roche made declarations that contracts between Borax Consolidated, Ltd., and nine German and Austrian firms for the supply of crude material for the manufacture of borax and boric acid, were abrogated and avoided since the outbreak of war under the Legal Proceedings against Enemies Act.

According to the *Chemiker Zeitung*, said counsel for plaintiff company, a precisely similar process had been adopted in Germany. This journal stated that all contracts for delivery made before the war or prolonged during the war which related to overseas goods were to be considered according to a judgment of the Imperial Supreme Court of October 15, 1918, as abrogated in consequence of the complete revolution in all the conditions of commercial intercourse. Therefore on a different ground and in a different way they had arrived at the same result.

Mr. T. W. Daniells, joint manager of the company, said that, judging from the price, there appeared to be only a very small supply of raw material in Germany for the manufacture of borax. The price of the refined product in Germany was £180 a ton as against £40 in England. Before the war the price was £17 to £20.

Sulphuric Acid Contract. *E. Packard and Co. v. S. J. Feldman and R. Partridge.*

In the Court of Appeal, on January 14, 15, the defendants in the above action appealed from a decision given in favour of the plaintiffs by Mr. Justice Roche, in July last, who awarded them damages for breach by the defendants of a contract to take delivery of sulphuric acid (see this J., 1918, 366 R).

Lord Justice Bankes, in the course of his judgment, said that he agreed with Mr. Justice Roche that at the interview between the parties in June, they were merely contracting about a temporary arrangement (*viz.*, that the plaintiffs should supply the acid to the Ministry of Munitions), and that the defendants were wrong in saying that they had the right to continue the arrangement as long as they pleased. It appeared, however, from the correspondence that plaintiffs were not anxious for the defendants to take delivery, because they were not satisfied with the latter's financial position. Plaintiffs consented to a course which allowed of the continuance of the arrangement originally intended to be temporary, but which actually continued until the expiration of the period covered by the contract; in fact, both parties were willing for business reasons that the temporary arrangement should continue. It did continue, and there was no breach of the contract as originally made, and as varied by the originally intended temporary arrangement in June.

Lords Justices Warrington and Duke concurring, the appeal was allowed, and judgment entered for the defendants with costs.

REPORT.

Mines and Quarries: General Report, with Statistics, 1917. *By the* Chief Inspector of Mines. Pt. I.—Divisional Statistics and Reports (Cd. 9120). Pt. II.—Labour [4*d*.]. Pt. III.—Output [3*d*.]. [H.M. Stationery Office.]

Labour. There were 8047 mines and quarries working during the year 1917, a decrease of 744 on the previous year, but the number of workers increased from 1,065,714 to 1,085,471. This last total was made up of :—Males underground 852,433, males aboveground 221,416, females aboveground 11,622.

Considering the various industries, we find that the bulk (92·7%) of the total workers was employed in coal mining, the remainder being distributed as follows:—Iron ore, 1·95%; limestone, 1·30%; igneous rocks, 0·87%; clay and brick earth, 0·60%; oil shale, 0·47%; sandstone, 0·47%; tin ore, 0·46%; slate, 0·35%; lead and zinc ores, 0·28%; other minerals, 0·55%. During the year there were 83 explosions of firedamp or coal dust resulting in 20 deaths and 111 persons injured.

Laboratory Research Work has been carried out at Eskmeals on (1) The propagation of flames of firedamp-air mixtures through tubes of small diameter. (2) The igniting power of sparks from magneto exploders and magneto telephones. (3) The ignition of firedamp-air mixtures by sparks from rocks and tools. The first research has been completed during the year, the remaining two are in progress.

There has been an increase in the use of coal cutting machinery, especially in Scotland, Yorkshire and North Midlands. The number of machines in use was 3799 (3459 in 1916) consisting of 1739 electrical and 2060 pneumatic. The quantity of coal won by machine cutters was 28,196,486 tons.

Output. The statistics of outputs compared with those of 1916 (see this Journal, 1918, 436 R) show an important decline in the coal production of nearly 8,000,000 tons but an increase in value of nearly £8,000,000. The production of iron ore was higher by 1,300,000 tons, and oil shale and salt from brine show small increases. On the other hand there were noticeable declines in the output of barium compounds, chalk, sandstone, and slate. Generally speaking, the quantities of the other minerals are of the same order as in the previous year with a tendency towards decline.

Coal and Coke. Of the 248,499,240 tons of coal produced the following amount was exported :—

	Tons.
As coal	34,995,787
1,278,646 tons coke equivalent to	2,131,077
1,526,272 tons manufact. fuel equivalent to	1,373,645
Bunkers for ships engaged in Foreign Trade	10,227,952
	48,728,461

Leaving 199,770,779 tons for home consumption, or 4·725 tons per head of the civil population. The percentage of the output shipped abroad continues to diminish being now 19·6; last year it was 21·5, while in 1913 it was as high as 34·2. As in the previous year the largest foreign buyer was France, who received over 17½ million tons; Italy took over 4 million and Norway and Russia over 1 million tons each.

Taking the statistics for the last 45 years (1873—1917), it is found that coal accounts for 85·4% of the total value of minerals raised (£4,273,436,842). The average pit-head prices for coal show considerable increases:—England, 16*s*. 1·6*d*.; Wales, 20*s*. 5·6*d*.; Scotland, 15*s*. 7·4*d*.; Ireland, 18*s*. 2·7*d*; average price for the whole of the United Kingdom, 16*s*. 8·7*d*. (15*s*. 7·2*d*. for 1916). The total quantity of

coal carbonised was 39,300,504 tons, made up of 8,440,074 tons at gas works and 13,555,051 tons at coke ovens (in 1916, 37,624,162 tons were carbonised). As regards the number and kind of coke ovens in operation, it is noticeable that the proportion of beehive ovens (42·4% of the total) remains practically the same as in 1916, and that in actual numbers they have increased from 6892 to 7013. The total number of ovens was 16,540 against 16,320 in 1916. The briquetting industry shows a small decline in the quantity of coal used (1,681,253 tons in 1917 against 1,760,717 in 1916) with a slight rise in the value of the products. In terms of coal used South Wales accounts for 89% of the total production.

Copper. From the 1159½ tons of ore mined, 187 tons of metal was obtained. The ore was therefore much poorer than in the previous year when 1028 tons yielded 278 tons of metal. During the year the imports were 16,554 tons ore; 28,238 tons regulus; and 145,392 tons metal (wrought and unwrought), while over 13,000 tons of metal was exported.

Iron. The following table gives the statistics for the chief centres of production of iron ores:—

County	Quantity	Price per ton
Under the Coal Mines Act (average 30% of iron)—	Tons	s. d.
Northampton... ...	135,884	3 5
Stafford (North) ...	754,061	13 6
York (N. Riding) ...	4,821,596	7 8
Ayr	124,852	22 5
Lanark	83,717	20 10
Renfrew and Inverness	114,490	11 9
Under the Metalliferous Mines Regulation Act—		Per cent. of iron
Cumberland	1,261,002	52·16
Gloucester	22,990	35·35
Glamorgan	54,930	51·00
Lancaster	308,312	51·07
From Quarries—		
Leicester	697,353	26·18
Lincoln	3,301,258	25·05
Northampton	2,269,410	32·10
Oxford and Rutland...	525,848	31·77

The following figures show the quantities of iron ore available for the furnaces of Great Britain:—

Total ore from mines and quarries in United Kingdom	14,845,734 tons.
Foreign ore imported (chiefly from Spain)	6,189,655 ,,
"Purple ore" (cinders from cupreous iron pyrites)	640,681 ,,
Total (less 667 tons exported)	21,675,403 ,,

Pig iron production	1917	1916
Works in operation ...	118	115
Furnaces built	487	485
Furnaces in blast ...	318	294
Pig iron made	9,338,104 tons	8,919,469 tons
Iron ore used (including cinders)	22,901,714 ,,	21,505,556 ,,
Coal used	2,816,318 ,,	2,612,543 ,,
Coke used	10,961,734 ,,	10,300,888 ,,

The average prices of pig iron during the year were:—Cleveland No. 3, quarterly ascertained prices, £4 17*s.* 4*d.*, quoted prices, £5 1*s.* 2*d.*; and all kinds of pig iron exported, £9 4*s.* 7*d.*

Iron Pyrites. In addition to the 8515 tons of native iron pyrites, 854,241 tons (chiefly cupreous iron pyrites) was imported.

Lead. The 15,322 tons of dressed lead ore yielded 11,250 tons of lead, and 73,094 ounces of silver. The mean monthly price of lead in 1917 was £30 per ton.

Manganese Ore. Only 9942 tons was obtained in North Wales (5140 in 1916), but 331,264 tons was imported during the year.

Oil Shale. The Scotch shales gave average yields of 20 gallons of oil and 40 lb. of sulphate of ammonia per ton of shale (in 1916, 20 galls. and 44 lb. respectively). The price at the mines was 8*s.* 2·5*d.* per ton, compared with 6*s.* 10·3*d.* in 1916.

Petroleum. Imports show a large increase from 451,556,152 gallons in 1916 to 826,895,771 gallons in 1917.

Mercury. Imports amounted to 2,173,434 lb. and exports to 434,215 lb.

Salt. 300,708 tons of British salt was exported.

Tin Ore. From the 6575 tons of ore 3936 tons of metal was obtained, the average yield from ordinary ore being 65·6%. The mean monthly price of standard tin was £237 13*s.* 1*d.* per ton. Imports amounted to 41,208 tons of ore and 27,143 tons of metal, while 19,265 tons of British and 18,124 tons of foreign tin were exported.

Tungsten Ore. The production of 241 tons shows a considerable decrease on the previous year's figure (394 tons). Cornwall produced 205 tons, Cumberland 32 tons, and Devon 4 tons. The average percentage of metal in the Cornish dressed ore was 62·75.

Zinc Ore. The quantity of metal obtained from the 7484 tons of ore mined was 2735 tons. The mean monthly price of spelter was £52 3*s.* 6*d.* per ton. The imports during the year were 87,368 tons of ore, 76,105 tons of crude zinc and 4105 tons of manufactured metal; the exports were 5 tons of ore and 8560 tons of manufactured zinc.

TRADE NOTES.

BRITISH.

Dominion Rubber System, Ltd.—Notice appears in *The Canada Gazette* of December 7 of the incorporation in the several Provinces of the Dominion of the Dominion Rubber System, Ltd., as follows:—Dominion Rubber System, Ltd., Montreal, $500,000, Alberta $500,000, Manitoba $500,000, Maritime $500,000, Ontario $1,000,000, Pacific $250,000 Quebec $1,000,000, and Saskatchewan $500,000.

The Fertiliser Situation.—The Food Production Department announces that the supply of fertilisers generally for the current season is much greater than it was last year, but considerable difficulties still exist in regard to transport, and prompt delivery cannot therefore be assured. The prices prescribed by the Fertiliser Prices Order for sulphate of ammonia, superphosphate and basic slag will remain unchanged up to June 1 next, and consumers will gain nothing by postponing their orders till later in the season. Arrangements have been made for the importation of a considerable quantity of phosphate rock. The demand for basic slag at the present time is greatly in excess of the production, but the total output for the whole season is likely to be about one-fifth more than it was in 1917-18. The slag is being despatched from the works as it is ground. Sulphate of ammonia is available in greater quantities than last year. It is understood that a number of makers have bone meal and bone flour for sale at lower prices

than those ruling a few months ago and immediate delivery of these materials can probably be obtained.

Board of Trade Returns for 1918.—According to statistics issued by the Board of Trade, the imports into the United Kingdom during 1918 had a value of £1,319,388,591 (*C.I.F.*), and the exports of home produce and manufactures were valued at £498,473,065 (*F.O.B.*), the former showing a gain of 24 per cent. and the latter a decline of 5·4 per cent. over the corresponding figures for 1917. The net excess of imports over exports increased by 52.8 per cent. The value of the imported oil seeds, nuts, fats and gums was nearly £41,000,000 higher at £116,643,336 (54 per cent.), and the imports of cotton were about £40,000,000 higher at £150,286,308 Those imports classified as chemicals, drugs, dyes and colours were valued at £38,543,957, as against £28,027,543 in 1917, and the exported value was £22,740,983, compared with £23,583,139. There was a notable decline of nearly 70 per cent. in the value of exported leather and manufactures thereof, and of over 65 per cent. in the value of exported oil seeds, etc.

FOREIGN.

Chilean Nitrate Trust.—At a meeting held at Valparaiso on January 10, the nitrate producers approved, by a majority of 84 per cent., of the articles of the Nitrate Producers' Association, an organisation which will control prices and production. These articles will now be presented to the Chilean Government for approval, and will come into conflict with another project already introduced into Congress by the Finance Minister, and which is supported by a minority representing 16 per cent. of the nitrate industry.

Twenty nitrate works have closed down, and in consequence there is much unemployment at the nitrate ports.—(*The Times, Jan.* 14, 1919.)

The Chemical Market in Japan (November, 1918).—The market for chemicals is very depressed, consumers having agreed to wait until more normal prices have been re-established. Soda descriptions are at a very low level, apparently as a reaction against their too rapid advances in the past and also because their production is steadily increasing. Soda ash is quoted at about 25*s*. per 100 lb. The price of caustic soda is still falling and at a much faster rate than soda ash, business is now done at about 67*s*. per 100 lb., or lower. Bicarbonate is overstocked and the market is extremely weak, but the price keeps steady at 58*s*. per lb. Nitric acid fetches 30*s*. per 100 lb., sulphuric has fallen from over 8*s*. to 7*s*., but hydrochloric acid has risen to 10*s*. per 100 lb. The price of acetic acid has been advancing sympathetically with that of salicylic acid (a result of the Spanish influenza), 96 per cent. acid being quoted at £6 per 100 lb. as against £5 8*s*. a few weeks before. The market for potassium compounds is slack, notwithstanding an improvement in the match trade and an increased demand for potassium chlorate, now selling at £7 per 100 lb. Potassium bichromate is also dull and foreign business has fallen off; the price is stationary at about £9 18*s*. per 100 lb. (yen = 2*s*.).

The Department of Agriculture and Commerce has issued a modification of the embargo on the re-export of certain chemicals. Sodium nitrate and potassium cyanide have been transferred from the list of articles conditionally embargoed to the "absolutely prohibited" list. It is hoped, officially, that the new ruling will protect home manufactures from the threatened shortage of raw materials, and control more effectively the supply of nitrate and other goods entirely supplied from overseas.

The Paint Market in Japan.—Before the war, Japanese manufacturers aimed merely at supplying the home demand, the overseas markets being regarded as negligible, but now they command a large trade, amounting almost to a monopoly, in China and the South Pacific. The value of exported paints, excluding red lead and other miscellaneous goods, at the end of July last was £186,219, compared with £22,987 and £14,198 at the corresponding time in 1917 and 1916, respectively. Japanese paint manufacturers and dealers have been working hard to improve their wares and their business methods in order to retain their new markets as a permanent asset; but it appears to be inevitable that foreign buyers should wait to see the effect of peace upon prices. The export trade, recently very brisk, is now sinking fast, and no new big orders are to be expected. Blue paints are quoted at 19*s*. 3*d*. for A grade and 11*s*. 3*d*. for B grade; yellow is quoted at 12*s*. per can (A) and 10*s*. 4*d*. (B), dark blue at 17*s*. 3*d*. per can (A) and 10*s*. (B), dark brown at 9*s*. 3*d*. (A) and 8*s*. 2*d*. for B. Zinc white is well maintained, but owing to the weakening tendency in the spelter market its tone is also very weak; grade "Treasure Sword" is quoted at 27*s*. per can containing 28 lb. Red lead is also weak at 19*s*. 3*d*. per can of 28 lb. Putty does not share in the general depression as visible stocks are small; the best grade is quoted at 13*s*. per 28 lb. (red) and 12*s*. (white).

Market Outlook in France for Chemicals and Dyes.—In order to combat the German chemical monopoly, the French Government organised, in 1917, the "Compagnie Nationale des Matières Colorantes et des Produits Chimiques" with a capital of 40 million francs. This company has now been operating for nearly twelve months, but it is believed that it will not be able to cope with the country's needs for many years to come, and that French consumers of chemicals and dyes must look abroad for such products. Before the war, Germany exported annually to France chemical products of the value of 61,292,000 francs. To this figure must be added the output of seven factories erected in France by German companies to escape import duties and cost of transportation. The German success was due, not merely to cheapness, but also to the large staff of carefully selected technical and research chemists at their disposal, and to the care taken to ascertain the exact requirements of consumers.—(*U.S. Com. Rep., Dec.* 6, 1918.)

Poland.—A new undertaking, called "Prosna," has been launched in Kalisch to exploit a process for welding metals with oxygen and to manufacture apparatus connected therewith.—(*Z. angew. Chem., Nov.* 22, 1918.)

Dutch East Indies.—The Quinine Factory in Bandong, in 1917, made a profit of 1766 million florins, and paid dividends amounting to 89·3%. The value of bark consumed was 2903 million florins, as against 2535 million in 1916, and the output of quinine was valued at about 1 million florins, in excess of that of the previous year. The prices of chemicals have risen very greatly. (Dutch florin = 1*s*. 8*d*.)—(*Z. angew. Chem., Nov.* 26, 1918.)

Spain.—The "Union Española de Productos Quimicos" produced 66,000 tons of sulphuric acid and 84,000 of superphosphate in 1917. In the first half of 1918 mineral phosphate was difficult to obtain, but since the conclusion of the agreement with France, three Spanish ships have been running regularly between Spain, Algiers, and Tunis, and the four factories belonging to the company have been in full operation.—(*Z. angew. Chem., Nov.* 26, 1918.)

French Indo-China.—A syndicate has been formed in Tonkin to erect a works for smelting indigenous zinc ores. Owing to freight difficulties, there are very large supplies of ores on hand, and for this reason the Japanese, who have pur-

chased practically the total production during the war, have not renewed their contracts. The prospecting and mining of zinc ores were formerly in German hands, closely connected with the "Metallgesellschaft."—(*Z. angew. Chem., Nov.* 11, 1918.)

Germany.—An arrangement has been made between the Government of Georgia and a group of heavy chemical manufacturers, including the firm of F. Krupp, whereby a new railway company ("Tschiaturi") is to be formed with the object of conveying manganese ores from the Caucasus to Germany. In peace time Germany imported 20 million poods annually from this source.—(*Z. angew. Chem., Nov.* 5, 1918.)

Sweden.—The I. L. Rose Company in Upsala is about to extend its works, where only scientific instruments have hitherto been made, in order to take up the manufacture of optical glass. Such glass was previously imported from Germany, France and America, and as the supply from these countries has ceased entirely, the shortage is at present very great.—(*Z. angew. Chem., Nov.* 8, 1918.)

Holland.—The glass works "Leerdam," formerly Jeekel, Mijnssen and Co. in Leerdam, has raised its capital by the issue of 500,000 florins of 6% preference shares. The works employ over 1300 hands, and it is intended to raise the capital further, to a total of 3 million florins.—(*Allgem. Handelsblad, Oct.* 15, 1918.)

COMPANY NEWS.

BOOTS, CASH CHEMISTS (EASTERN), LTD.

The twenty-sixth ordinary general meeting was held in London on January 15, Sir Jesse Boot (chairman and managing director) presiding. In his address, the chairman referred to the large reserves and carry-over possessed by the Company, the latter being sufficient to pay a full year's dividend on the ordinary shares. He then made special reference to the valuable work in connexion with the war carried out by the parent company—Boots Pure Drug Co., Ltd. Collaboration between the late Col. E. F. Harrison and the Company's research staff had resulted in the production of a material for charging the box-respirators which had proved most effective. For several months the Company made and prepared all the box-respirators that were turned out; further, it had manufactured almost the whole of the chemicals for the 20 million box-respirators produced, and delivered $7\frac{3}{4}$ millions complete for the use of the British American and Italian forces. The work undertaken for the military authorities had led to no excessive profits: the Company had received 8—10 per cent. on war contracts, subject to tax, and the net profit was only $1\frac{1}{4}$—$1\frac{1}{2}$ per cent. The additional buildings and the power-house were erected at the Company's expense, the only help received from the Government being in regard to priority for building materials. During the war, 115 million tablets for sterilising water had been supplied to the army, and latterly great progress had been made in the manufacture of saccharin; no less than 1785 million tablets—the whole of the production—had been supplied to the Government. While the Company was being urged to manufacture on a large scale by the Sugar Commission, another State Department had tried to restrain it under the threat of heavy penalties. The branch businesses had only received their due proportion, and none had sold the imported material, which was not controlled and upon which the selling profit was very much greater.

In regard to the future of saccharin manufacture, the Government might reasonably be expected to give encouragement to a business mainly undertaken to assist it, until its infancy is past and until business conditions generally resume their normal course. Foreign stocks, which accumulated under the impetus given to foreign manufacture through unrestricted prices, threaten to swamp the market, and the home producer, who has had no time to overcome all the difficulties incidental to new work started under very adverse conditions, will have to compete in a market where saccharin will be offered at unremunerative prices. Moreover, certain conditions are imposed upon the home manufacture for revenue purposes, which involve an extra cost and from which the imported product is exempt.

OFFICIAL TRADE INTELLIGENCE.

(*From the Board of Trade Journal for January* 9 *and* 16.)

OPENINGS FOR BRITISH TRADE.

Canadian firms wish to represent British manufacturers of preserved foods, sugar syrup and malt vinegar. Inquiries should be addressed to The Canadian Government Trade Commissioner, 73, Basinghall Street, E.C. 2.

A firm at Vancouver seeks agencies for U.K. manufacturers of linoleum; and a Canadian wishes to get into touch with U.K. importers of mica and phosphate. Inquiries to The High Commissioner for Canada, 19, Victoria Street, S.W. 1.

Agents at Montreal desire to represent U.K. manufacturers of chemicals and tungsten lamps. [Ref. Nos. 20, 22.]

A merchant at London, Ontario, wishes to obtain agencies for U.K. manufacturers of hardware, sheet glass and linoleum. [Ref. No. 24.]

A firm at Calcutta wishes to obtain agencies for U.K. manufacturers of ink. [Ref. No. 17.]

An agent at present serving with the New Zealand forces desires to represent in New Zealand U.K. manufacturers of colours, paints, oils and varnishes. Inquiries to The High Commissioner for New Zealand, 415/6 Strand, W.C. 2.

A firm at Wellington desires to get into touch with U.K. manufacturers of preserved foods and artificial manures. [Ref. No. 40.]

A Netherlands firm wishes to get into touch with U.K. manufacturers of sheet copper, copper ingots, wire and tubes. [Ref. No. 13.]

A merchant in Milan desires agencies for U.K. manufacturers of ceramic manufactures. [Ref. No. 43.]

An agent at Ceuta, Morocco, wishes to represent U.K. manufacturers of pharmaceutical products, paints, varnishes, preserved foods and sugar. [Ref. No. 12.]

TARIFF. CUSTOMS. EXCISE.

Brazil.—Recent customs decisions affect the import duties on porcelain (faïence), machine belting, aluminium wire and linseed oil.

Canada.—Malt sugar, malto-dextrin, rennet powder and vinegar are among the articles the export of which is prohibited, except under licence, as from October 26.

The import duties on spermaceti wax and rit dye have been amended.

France (Algeria).—As from January 1, importations of chicory root, glucose, sugar, mineral oils and alcohol will be subject to the municipal *octroi de mer* duties in addition to the ordinary customs duties.

French Colonies.—The decree of October 15 concerning the prohibition of the exportation of certain

articles from France is now extended to the French Colonies, other than Tunis and Morocco, as from December 22.

Liquorice juice may be exported without special authorisation from French Colonies to the U.K., Belgium, Italy, or extra-European countries as from December 16.

Japan.—The export and re-export of the cyanides of potash and soda nitrate of soda and tinplate are prohibited.

Netherlands East Indies.—The export of kapok and other fibres, oil seeds, tanning materials, rubber and all kinds of gutta is prohibited, except under licence, as from November 5.

New Zealand.—Recent customs decisions affect the import duties on bronze, bottles, camphenol, certain kinds of glass and tincture of cantharides.

Nigeria.—"Common gunpowder" or "trade powder" is defined as large grain black powder similar to and not of appreciably better quality than that commonly known as trade powder at the date of the coming into force of the General Act of the Brussels Conference, *viz.*: April 1892.

Sweden.—The customs duties on oleomargarine, condensed milk, etc., are suspended for a further period to June 30.

United States.—The instructions contained in the War Trade Board Ruling No. 234, issued on September 18, have been revoked as from December 18, and Consuls have been instructed to certify invoices without official notification from the War Trade Board upon production of a letter or cablegram from the consignee giving the import licence number, commodity and quantity thereof licensed

Individual export licences are still required for, *inter alia*, camphor, chestnut and quebracho extracts, cinchona bark and extracts, copra, glucose, lard, certain edible oils, paper and sugar.

Further recent rulings of the War Trade Board affect rubber, tanning materials, corundum, asphalt, asbestos and manufactures containing gold.

GOVERNMENT ORDERS AND NOTICES.

EXPORT PROHIBITIONS.

The Board of Trade has announced the following relaxations of existing export prohibitions, to be valid on and from the dates specified:—

Headings transferred from one list to another.

From List A to List B:—

Carborundum, alundum, crystolon, and all other artificial abrasives and manufactures thereof.—(Jan. 9.)

From List A to List C:

Beeswax; lacs, not including lac dye; lubricants not otherwise specifically prohibited and articles and mixtures containing such lubricants; mineral jellies; motor spirit; oil fuel; oil fuel shale; paraffin oil; petroleum fuel oil; petroleum gas oil; petroleum lighting oil; petroleum spirit and articles containing; petroleum and its products not otherwise specifically prohibited and mixtures thereof; turpentine (oil and spirit) and articles containing; turpentine substitute and articles containing; acetic acid; acetic anhydride; acetylsalicylic acid (aspirin) and its preparations; anti-tetanus serum; arecoline; buchu leaves; calcium carbide; calumba root; cascara sagrada and its preparations; culvers root; formic acid; formic aldehyde; hydrastis canadensis and hydrastine; liquorice root and juice; male fern rhizome; mannite; paraformaldehyde; podophyllum rhizome; sassafras root; scammony root; senega root; trional; trioxymethylene; valerian rhizome; witch hazel bark and leaves; zinc oxide and mixtures containing.—(Jan. 9).

Cobaltchrom and similar alloys; gum arabic; gum tragacanth; hemp of all kinds; packing cases; platinum, alloys of platinum and manufactures containing; titanium, titanium alloys and titanium ores; tungsten alloys; tungsten (except tungsten filaments for electric lamps); wire, galvanised; manganese, peroxide of, and mixtures and preparations thereof; platinum, salts of; soda crystals; zirconium compounds.—(Jan. 16.)

From List B to List C:—

Oiled insulating cloth, paper, silk and tape; vulcanised fibre; osmium and its alloys and manufactures containing; rhodium and its alloys and manufactures containing; ruthenium and its alloys and manufactures containing; tin, manufactures of not otherwise specifically prohibited; carbon disulphide; chlorates, metallic, other than potassium chlorate (which remains on List A); rhubarb, medicinal.—(Jan. 9.)

Ferro-manganese; ferro-silicon; ferro-titanium; gums containing caoutchouc; manganese and manganese ore; nickel, its ores and alloys; oil waste; resinous substances containing caoutchouc; selenium; silicon manganese; spiegeleisen; thorium and its alloys; tungsten ores (including ferberite, hubnerite, scheelite and wolframite); chromium acetate; chromium chlorate; chromium nitrate; hydrogen peroxide.—(Jan. 16.)

Altered Headings.

(B) Nitrate bags; (B) henbane; (C) preparations of henbane not otherwise prohibited; (A) oils, fixed, all animal and vegetable, including blended oils and paint oils; (C) articles and mixtures containing fixed oils, not otherwise specifically prohibited; (A) potash, muriate, sulphate and crude manurial potash salts, and mixtures containing any of these substances; (C) potash nitrate (saltpetre); (A) tin, oxide of; (C) mixtures and preparations containing tin oxide not otherwise prohibited; (A) zinc sulphide; (C) mixtures containing zinc sulphide not otherwise prohibited. (Lithopone remains on List A.)—(Jan. 9.)

(A) Ammonia, sulphate of, and mixtures containing; (C) ammonia and its salts not otherwise prohibited; (B) bichromate of soda; (C) chromium compounds and mixtures containing such compounds, not otherwise prohibited; (B) gall nuts; (C) extracts of gall nuts.—(Jan. 16.)

Exports to Switzerland.—The Director of the War Trade Department announces that an open general licence has been issued permitting the export to Switzerland of the goods specified below. Applications for specific licences in respect of these goods are not now required, and it is not necessary for any of them to be consigned to the Société Suisse de Surveillance Economique.

Celluloid wares; china clay; arsenobillon; arsenious acid; cacodylicate; chromic acid; cocaine; paraldehyde; phenacetin; salicylic acid; sodium arsenate; marble, raw and manufactured; photographic goods, but not chemicals therefor.

In the case of the following goods licences are still required, but consignment to the S.S.S. and production of S.S.S. Certificates are not necessary:

Aconite, preparations and alkaloids; amidopyrine; betanaphthol; essential oils; fructus fœniculi; hydrobromic acid; liqueurs; nitrate of silver; opium, preparations and alkaloids; sodium bromide; sodium nitroprusside.

Formaldehyde.—All restrictions on the sale and purchase of formaldehyde have been removed by the Government of the United States, and free export as in pre-war times is permitted as from January 1, 1919.

The Army Council gives notice that further consignments of this chemical will not be requisitioned on arrival, and that the Formaldehyde (Dealings)

Order of July 8, 1918, fixing prices, will be cancelled as from March 1, 1919.

Export of Leather and Tanning Materials.—The Director of the War Trade Department announces that applications will now receive consideration, in approved cases, for licences to export the following goods:—

Upper leather produced from East India tanned, home tanned, vegetable or pyrotanned kips; myrobalans, nuts and extract; mangrove bark and extract; mimosa bark; cutch.

Paraffin Wax.—The Director of the War Trade Department announces that he is prepared to grant licences for the export to all non-enemy destinations of reasonable quantities of Scottish paraffin wax of melting-point under 120° F.

STEEL AND IRON (PURCHASE AND RETURNS) ORDER, 1919.

The Minister of Munitions gives notice and orders:—

(1) On and after January 7, 1919, no purchase shall be made or delivery taken of iron or steel by any person holding at the date of such purchase any stock of iron and steel, or either of them, exceeding by more than 100 tons the amount of such stocks held by him on October 31, 1915, or October 31, 1918, whichever shall be the greater amount, except with a special permit from the Minister of Munitions.

(2) All persons who on April 30 shall hold a stock of iron and steel, or either of them, of 100 tons or more, shall, within fourteen days after April 30, furnish to the Controller of Iron and Steel Production, a return of the stock held by them on either of the dates in (1) above, whichever shall be the greater, and also of the stock held by them on April 30, on a special form.

(3) All iron and steel not actually incorporated in any building or structure or work in progress shall be deemed to be stock, but the iron and steel referred to shall not include scrap.

[The full text of the Order is given in the *London Gazette* of January 7.]

THE BISMUTH (AMENDMENT) ORDER, 1919.

The Minister of Munitions, under date January 10, has modified the Bismuth Order, 1918, by eliminating the obligations contained in Clause 2 (5), and by enlarging the class of persons exempted by Clause 2 (6) from the necessity of making any returns. The exemption applies to holders whose stocks have not exceeded 56 lb. of bismuth metal or alloys during the period for which returns were compulsory, provided the material was not intended for use in the manufacture of steel or steel alloys.

OTHER ORDERS AND NOTICES.

The Icelandic Wool and Tops Permit, 1919. War Office, January 7.

The Sale of Coal (Ireland) Order, 1919. Board of Trade, January 10, 1919.

The Electricity (Restriction of New Supply) (Revocation) Order, 1919. Ministry of Munitions, January 10.

The South African Wool and Tops Permit, 1919. Army Council, January 11.

The Silk Waste or Noils (Returns) (Suspension) Order, 1919. Ministry of Munitions, January 14.

The Tar Oils Control (Suspension) Order, 1919. Ministry of Munitions, January 15.

The following Orders were cancelled by notice given by the War Office on January 11:—The Flax Yarns (Shipment from Ireland) Order, 1918. The Flax Yarns (Shipment from Ireland) Amendment Order, 1918. The Cotton Cuttings (Control) Notice, 1917.

The Admiralty has cancelled the Oxygen Order, 1917.

The Secretary of State for the Home Department has given notice that on January 6, 1919, he made a Scheme of Compensation under the Workmen's Compensation (Silicosis) Act, 1918, for the refractories industries. Copies of the scheme can be obtained through any bookseller or from H.M. Stationery Office.

With reference to the Household Fuel and Lighting Order, 1918, the Controller of Coal Mines gives notice that the conversion equivalent for gas in terms of fuel shall be increased to 18,750 cub. ft. to the ton, and for electricity to 1000 Board of Trade units to the ton, as from meter readings taken for the close of the quarter ended December 31 last. The allowances for lighting are also increased by 25 per cent.

REVIEWS.

Dyeing with Coal Tar Dyestuffs. *By* C. M. Whittaker. *Pp.* x + 214. *(London: Baillière, Tindall and Cox,* 1918.) *Price 7s. 6d. net.*

After a brief historical summary of the art of dyeing, the author devotes the succeeding ten sections to a discussion of the coal tar dyes classified from the viewpoint of the dyer, although the more elaborate classification required by colour chemists is also indicated.

The basic dyestuffs, a group which includes the first coal tar colouring matters to be synthesised, are still widely used, in spite of their general fugitiveness to light, because of the brilliancy of their shades especially when applied to silk. The employment of these colours in cotton dyeing introduces the subject of mordanting, and the tannic acid and tartar emetic process is treated fully.

The acid dyestuffs, largely used for wool and silk dyeing, form a numerous section of colouring matters including at least nine important chemical series of dyes. Their application to the animal fibres is relatively simple, but due attention is paid to the use of assistants in producing level shades.

The section on mordant dyestuffs includes not only the truly adjective alizarine colours but also the acid mordant colouring matters which behave as substantive dyes, the shades of which are modified and rendered faster by the intervention of a mordant. The intricate art of producing satisfactory shades of Turkey red on cotton is illustrated by two complex recipes. The three methods of chroming are also mentioned, and the important fast chrome blacks for wool are fully discussed, especially those brands which show marked resistance to "potting."

The direct cotton colours have the largest vogue of any class of synthetic dyes on account of the ease with which they are applied to unmordanted vegetable fibres. The resulting shades are not as a rule fast to light and washing, but these disadvantages have been overcome in certain instances by after-treatment with bichromate, formaldehyde, or copper sulphate. Diazotised paranitroaniline is used in increasing the depth of shade in certain cotton blacks, but it is scarcely necessary to give full details for the preparation of this reagent on p. 77 when the recipe is repeated almost word for word on p. 87 in connexion with the production of insoluble azo-pigments ("azoic" dyestuffs) on the vegetable fibres. The latter process, patented by Messrs. T. and R. Holliday in 1880, has been the subject of much subsequent research. Naphthol A S, the anilide of β-hydroxy-3-naphthoic acid, introduced shortly before the war, is a valuable

substitute for β-naphthol in the production of these insoluble pigment dyes.

The application of sulphur dyestuffs is exemplified by several recipes for the dyeing of sulphur blacks. Where prescriptions are so extremely practical, much may be forgiven to the author in the way of phraseology, but more drastic editing might have been exercised in many of the technical descriptions, of which the one set forth on p. 106 may be cited as a representative specimen :—

"Then the cotton is allowed to feed in the simmering bath for at least half an hour, when unless the cistern is required, shut off steam and allow the cotton to feed in the cooling bath . . . one lot being put in at the end of the day, and taken out first thing in the morning, another lot put in straightaway and taken out in time to get the lot in for the night."

This paragraph may represent sound dye house practice, but it is curious English. The following sentence (p. 153) "These dye on fades though they are not practical politics in the garment dyeing trade" is an unnecessary colloquialism which has not even the merit of being informing.

The section on vat dyestuffs contains references not only to indigo but also to the most modern vat dyes, including hydron blue. The section on colours produced by oxidation, which introduces the principal methods of producing aniline black, is followed by sections on other uses of coal tar dyestuffs, vegetable and mineral dyes, and the valuation and detection of dyestuffs.

This treatise, which throughout contains an immense amount of first-hand practical information, may be recommended not only to students of dyeing but also to all chemists who are likely to encounter problems connected with the manifold applications of the coal tar dyewares.

G. T. Morgan.

A Memoir on British Resources of Refractory Sands for Furnace and Foundry Purposes. *Part I. By* P. G. H. Boswell. *With Chemical Analyses by* H. F. Harwood *and* A. A. Eldridge. *Pp.* xii + 233. *(London: Taylor and Francis,* 1918.) *Price* 8s. 6d. *net.*

Of the many books originating from the exigencies of war conditions, the work here reviewed is not the least notable. As is well known, before the war many refractories—both finished products and raw materials—were imported into Britain from abroad. Among them were refractory sands, and their employment had become so much a matter of course that no one seriously attempted to use native materials in their stead. When the foreign sources of supply were cut off, efficient substitutes had to be found quickly in order to meet the demands of steel manufacturers. In these circumstances the freightage, which in many instances before the war would probably have been a serious consideration, became quite a secondary matter. The author was commissioned by the Ministry of Munitions to undertake systematic investigations with a view to reporting as early as practicable, and a Memoir (second edition since issued) on British sands suitable for glass manufacture appeared previously (this J., 1918, 63 R). The present part treats mainly of the chief supplies of British refractory sands available. The first three chapters are simply reprinted from the Glass-Sands Memoir, being of an introductory nature and common to both subjects. Indeed, many of the refractory sands with high-silica content are used for making glass.

The author has attempted—and on the whole very successfully—to give a clear account of the ways in which the sands are actually used for different purposes, and discusses the properties most important for these several purposes. For convenient treatment he has grouped them into high-silica sands and moulding-sands. High-silica sands are used for making and repairing the baths of acid steel furnaces, for the beds of soaking pits and reheating furnaces, for making silica bricks and crucibles, and with the addition of a binding material as moulding-sands for casting metals and alloys. The moulding-sands in general use mostly have a strong natural bond.

The results of Prof. Boswell's survey have apparently provided good grounds for his opinion that many sands were unnecessarily imported, and others were equally unnecessarily moved from one part of the country to another. The information collected (including prices) concerning sands for use in furnaces and foundries should greatly facilitate the selection of sands for trial with a view to adoption of the most suitable. The necessary particulars have not hitherto been available for the purpose.

With reference to laboratory work, details are given of the chemical composition of sands (in bulk and also of the separate grades), of the mineral composition, and of the mechanical composition. It is remarkable to what an extent the mineral composition—which is not in itself very important apart from the relative proportions of quartz and felspar—is characteristic of the sands from certain geological formations. The nature of the heavy detrital minerals which occur as minor constituents of the sands often affords a valuable indication of the identity and source of a particular sand.

Mechanical analysis may be effected by sifting or screening in the case of coarse sands, but elutriation is necessary for fine materials, which cannot be accurately graded by sifting. A simple form of single-vessel elutriator is described. The graphical representation of the mechanical composition of sands serves to bring out many interesting points.

For such a work, typographical errors seem to be exceptionally few and unimportant. Of the misprints noticed, only those in two consecutive lines on p. 40 (concerning minor inversions) are likely to cause any mystification.

Part II., which is to deal with further sources of supply, and additional results of tests, will doubtless be looked for with keen interest.

J. A. Audley.

PUBLICATIONS RECEIVED.

A System of Physical Chemistry. *By* W. C. McC. Lewis. *Second Edition. In three volumes. Volume I., Kinetic Theory. Pp.* 494. *Volume II., Thermodynamics. Pp.* 403. *(London: Longmans, Green and Co.* 1919.) *Price per volume* 15s.

Technical Handbook of Oils, Fats and Waxes. *By* P. J. Fryer *and* F. E. Weston. Vol. II., Practical and Analytical. *Pp.* 314. *(Cambridge: The University Press.* 1918.) *Price* 15s.

Sugar Beet Seed. *By* T. G. Palmer. *Pp.* 120. *(New York: J. Wiley and Sons, Inc. London: Chapman and Hall, Ltd.* 1918.) *Price* 6s. 6d.

Surface Tension and Surface Energy and their Influence on Chemical Phenomena. *By* R. S. Willows *and* E. Hatschek. *Second edition. Pp.* 115. *(London: J. and A. Churchill.* 1919.) *Price* 4s. 6d.

Catalytic Hydrogenation and Reduction. *By* E. B. Maxted. *Pp.* 104. *(London: J. and A. Churchill.* 1919.) *Price* 4s. 6d.

THE ORGANISATION OF A FACTORY LIBRARY.

W. BARBOUR.

Readers of the Journal of the Society of Chemical Industry may be interested to hear particulars of the actual working of the system of indexing referred to in the issue of the Journal for February 28, 1918 (67 R). The description which follows refers not only to the work of indexing but to that of organising library procedure.

The library is maintained for the purpose of collecting and supplying for the use of members of the staff all available information relating to the products, methods and processes in which the firm is interested.

Every document in the library is filed under one or other of the following classes:—

Class A, patents; B, books or pamphlets; E, extracts and cuttings; P, periodicals; Q, general typescripts and manuscripts; R, reports; G, record charts.

Class A, patents, is divided into sections as follows:—

Patents of the United Kingdom ...	A1
,, ,, ,, British Colonies ...	A2
,, ,, France	A3
,, ,, Germany	A4
,, ,, Belgium	A5
,, ,, United States	A6
,, ,, other countries	A7
Books of Patents	A8

In each section the individual patents are numbered consecutively thus:—A1.1, A1.2, etc.

Class B, books and pamphlets, is divided into sections as follows:—

Science	B1
General Technology	B2
Explosives Technology	B3
Engineering	B4
General	B5
Trade Catalogues	B6
Books, written or typewritten, and not subject to alteration	B7

In each section the individual books or pamphlets are numbered consecutively, thus:—B1.1, B1.2, etc. Pamphlets are numbered in each section from 901 onwards.

When a new edition of a book is filed it receives a call number which allows it to be filed alongside the earlier editions of the same work. If the first is B2.1, the second edition filed will be B2.1/1 and the third edition B2.1/2. If duplicate copies of books which will be in constant demand are filed the respective copies are marked thus $\underset{1}{\text{B2.1}}$, $\underset{2}{\text{B2.1}}$ for a first edition and $\underset{1}{\text{B2.1/1}}$ and $\underset{2}{\text{B2.1/1}}$ for a second edition. A third copy would be $\underset{3}{\text{B2.1/1}}$. The individual volumes of a given work are also marked in the same way, *e.g.* B1.251/1, B1.251/2, etc. In Class E, the extracts and cuttings are numbered consecutively, thus:—E1, E2. These cuttings are taken from issues of publications which are not filed regularly. The issues obtained are of interest on account of one or more articles to which reference has been made in the literature. These articles are cut out, pasted in a scrap book and marked as indicated.

Class P, periodicals, is divided into sections; each section contains all the issues of a given periodical, and each issue has its individual call number. The *Zeitschrift für Analytische Chemie*, for instance, is P22. The last volume of the periodical filed was P22.59. The volume now being received in parts is P22.60.

Class Q, general typescripts and manuscripts, is divided into sections according to origin. These sections range from Q1 to Q5. Translations of typescripts are filed with the originals in the Q class. All other typewritten translations are filed in Q5. Where possible, the original of each translation is also filed in its appropriate class. The original bears in a prominent position the call number of the translation, thus:—"For translation see Q5.9" and the translation, similarly, carries a reference to the original, thus: "For original see E1586."

Class R, reports, is divided into sections also according to origin. The form of reports is standardised.

Class G, record charts, is divided into sections, *e.g.* barograph charts G1, Hyetograph charts G2, etc.

The various classes of documents are arranged in alphabetical order on the shelves, excepting Classes Q and R, which are filed in vertical cabinets. The progression on the shelves is from left to right and from top to bottom, two vertical sections of the shelves counting as one width. Class A is filed in cardboard cases and arranged on the shelves. Class B is arranged on the shelves in seven sections. Class E follows on and consists of bound extracts and scrap books. Class P follows, and under each P number come together the bound volumes, and then the current issues in a pamphlet box. In the vertical cabinets are filed Class Q in red covers and Class R in green covers.

Each document has its call number, in the right hand top corner, either on the outside page, or on the title page or on both. Class B also has its call number on the back. All documents are arranged or filed by these call numbers:—(1) in order of their class initial A, B, E, G, P, Q, R, (2) in order of their class sections if any, (3) in order of the consecutive numbers after the sectional numbers.

The arrangement of the documents on the shelves is shown by movable label holders. Call numbers are given to all materials on their receipt in the library.

Class D, drawings, are filed in the drawing office and Class C, correspondence, in the correspondence department, the system of call numbers adopted in the latter cases being somewhat different from that given above.

For the purpose of securing quick access to all the documents bearing on any given point, card indexes have been developed. The index dealing with drawings is housed in sixty drawer cabinets in the drawing office. Exigencies of space prevent a detailed description of this. In the library itself are the two card reference systems in which the information contained in documents other than drawings is systematised. These two card systems which are contained in similar sixty drawer cabinets are known as the Dictionary Catalogue and the Central Index.

The Dictionary Catalogue deals with Class B only. Every book or pamphlet is entered in it under its title, its author, and such of its subjects as are of interest. The Dictionary Catalogue author cards are blue, title cards are pink, and subject cards are white. They are all arranged in one continuous alphabet and all bear in their top right hand corners the call numbers of the documents to which reference is made. The author cards contain the names of the authors in the top left hand corners. These are the terms which determine their position. Lower down on the author cards is given the title of the document. The title cards bear the titles in the top left hand

corners. Definite and indefinite articles at the beginnings of titles are ignored for purposes of filing. Lower down on the title cards is given the name of the author. The subject cards bear the subject term in the top left hand corner; lower down on the subject cards are given the title and author of the document. The terms on the top left hand corners of subject cards, which we shall speak of as filing terms, may be either substantival, participial or gerundive. For each book there is a main card in the Central Index. This is described below. Connexions between terms, relating of synonyms, etc., are effected by means of buff guide cards by a method similar to, but somewhat less elaborate than, that adopted for the Central Index. Stated briefly the main function of the Dictionary Catalogue is to act as the complement of the Central Index.

The Central Index brings together, by means of cards, all useful information from whatever source. The documents from which the information on the index cards is drawn are indicated by the colour of the cards as follows:—

Class A, Patents	White Cards
,, B, Books and Pamphlets ...	Pink Cards
,, C, Correspondence	Salmon Cards
,, D, Drawings and Illustrations	Blue Cards
,, E, Extracts and Cuttings ...	Brown Cards
,, P, Periodicals	Green Cards
,, Q, Typescripts, etc.	Yellow Cards
,, R, Reports	Buff Cards

The Central Index consists of two sections, main cards and index cards. The main cards are arranged by classes, each document being represented by a card and the cards being arranged in exactly the same order as the documents on the shelves and in cabinets. All main cards are white and give on the front (1) the call number at the top right hand corner, (2) the author, (3) the title, (4) the number of pages and illustrations, (5) publisher, (6) price, (7) dimensions. On the back of each main card are given in alphabetical order all the subjects under which a particular document has been indexed and catalogued, each term representing one card. Correspondence, periodicals and extracts or cuttings have no main cards. In the case of Extracts, cards bearing in the top left hand corner the names of the various documents obtained for cutting purposes at various times are filed alphabetically and on these are given the call numbers and titles of the articles indexed with date of appearance. A glance at this drawer suffices to show exactly how many articles have been indexed from a given journal in a definite period. In this way a judgment may be formed regarding the advisability of taking a journal regularly and filing it. When a journal is taken regularly and filed it is placed in class P.

The index cards are arranged alphabetically, the filing term being placed in the top left hand corner. The filing term in the central index is substantival and must be confined to "concretes." A fairly good definition of a "concrete" for indexing purposes is to the effect that it is a term denoting something marketable or capable of being marketed. Light and electric energy are concretes. At the top right hand corner of the card is the call number. Below this is the "process" term. The "process" term is a subsidiary filing term, denoting action, quality, property, etc., *e.g.* toxicity, stability, detonation velocity, purification, solubility. The cards filed under the concrete "guncotton" are arranged in alphabetical order of "processes," and so for any group of cards filed under the same concrete. If cards contain a country term this occupies a midway position between the concrete and the process terms at the top of the card. The country term when it is present is the term which ranks next to the concrete for filing, the process term being that used last. Below these filing terms is given (1) date on which the information was known, (2) a digest of the information in so far as it is of interest in connexion with the filing terms, (3) name of document or publication, (4) date of publication, (5) author's name, (6) in the case of an abstract the name of the journal, etc., in which the original information appeared. A definite position is assigned to each of these items on the card. A reproduction of an index card is given here.

> GRENADE B3.258
> DESCRIPTION
>
> 1917. Constructional and operating details are given of British, French and German grenades used at present. In most cases a diagram is given of each and explosive charge is specified. Descriptions are also given of the Nobel and Brock Fuse Lighters and Detonators used on some British grenades. It is stated that when mixed with a lead oxide, tetryl is safer and less sensitive than mercury fulminate for use in detonators.
>
> Hand Grenades, 1917
> Major G. M. Ainslie

Five position guides are used; they serve a twofold object, to indicate the alphabetical position of the term on the tab, and to show the relationship of the term on the tab with other information in the index.

We now come to the procedure followed in the work of indexing:

The papers and periodicals which arrive each morning are first of all marked with their call numbers and stamped with a dating stamp which bears the name of the firm. Leaves are cut if necessary. These documents are then passed to the indexer who selects material for indexing. The latter has access, later in the morning, to the previous day's correspondence from which he selects material also. Correspondence and communications are also sent to him from various departments for indexing. The Drawing Office send slips bearing particulars of drawings which require indexing. All members of the Q and R classes are indexed. Books may be indexed throughout for the Central Index, or in part for the Central Index and as to the remainder for the Dictionary Catalogue, or wholly for the Dictionary Catalogue and not at all for the Central Index.

The indexing of the selected material is carried out by writing on paper slips the material to be typed on cards or this may be dictated to the typist directly. The cards typed on a given day are checked on the following morning. Each item indexed is marked in the original with a blue ring by means of a rubber stamp. Readers of the document can then see at a glance what has been indexed and are enabled to suggest further indexing if they think this necessary.

When this has been done the cards are put away in a drawer of the card cabinet and this procedure is continued till a week has elapsed, when the cards for that week are assembled and those which bear the most comprehensive digests of matters of interest are arranged in alphabetical order under headings such as "Science," "General Technology," "Explosives Technology," "Engineering," and "General," and transmitted to the printer who makes up this material into a periodical issued weekly to members of the factory staff. This periodical contains also particulars of addi-

tions to the library and other matters affecting the work of the staff. The periodical is not an essential part of the organisation however.

When these selected cards have been returned from the printer the whole of the cards for the week are taken in hand again for consideration with regard to actual filing in the index. Those bearing names of firms, of authors, or of persons mentioned in articles indexed are placed by the typist in the drawers together with their guide cards in the positions to be occupied by them, but they rest on the rods which pass through the perforations at the bottom of the cards already filed and thus project above the latter. They are not let down finally till their positions have been carefully checked by someone having thorough knowledge of the principles of filing. The remainder of the cards are then very carefully scrutinised in order to select entries to be made in the "process" section of the index. The "process" section of the index is constituted as follows. It will be remembered that the subordinate filing term appearing in the top right hand corner of the card below the call number is called the "process" term and partakes generally of the nature of a gerund, *e.g.* stabilising, separating, purifying, though terms like accident, fire, explosion, solubility, etc., also occur. When an index is started a list of the terms of this type which may conceivably prove useful is compiled, and extreme care should be taken to make this list as exhaustive as possible from the very start. Should it occur that a "process" term must be added to this list after the index has been established for some time, this will involve a close scrutiny of all the cards filed in order to secure the references to this particular term. If the age of the index is appreciable the labour involved will be proportionately formidable.

To resume the description of the treatment of the cards accumulated in a week—the indexer scans each card and dictates to a typist the terms in the "process" section which should be entered in connexion with that card. He does not confine himself to the single "process" term appearing at the top right hand corner of the card. Other terms may be mentioned explicitly in the text appearing on the card, or they may be involved implicitly in the text. The typist makes shorthand notes lightly in pencil on each card and when the whole of the cards have been scrutinised in this way she withdraws to enter up the references and returns later to have them checked as regards accuracy. This completes the week's work as regards the "process" section. A reproduction of a typical process section card is given below:

(2) ACCIDENT

to Electric Arc Welder......E2380

to Electric Plant Worker......P39.45—352,

with Ether Drum......P82.11—75,

with Evaporator......P82.11—65,

in Glycerin Nitrator House R1.1711,

with Glycerin Nitrator Lead Fume Pipe......
R1.1711

In the course of selecting "process" section references many cards will have been ignored for that purpose since they involve no ideas which can be brought under the limited number of terms occurring in the process section, or on account of the fact that their utilisation would involve duplication. If, for instance, two cards are made for a given article, one for nitroglycerin—solubility (in water—B3.1156—7) and the other for water—dissolving (N/G—B3.1156—7) the process term "solubility" is chosen, the entry "of N/G in water . . . B3.1156—7" is made on the "solubility" card of the "process" section and the card for "water—dissolving" is neglected if it involves no other "process" term.

During the work of bringing the "process" section up to date, the opportunity is taken of simplifying subsequent work in connexion with "related terms." A short explanation of this phrase is necessary.

It is claimed for the Kaiser system of indexing that by the use of guide cards, bearing related terms, not only is all cross-referring necessary made possible, but the total number of cards required for quick and accurate consultation of the index is greatly reduced. A guide is a buff coloured card similar in size to all the other cards but differing from these in the possession of a projecting tab which may occupy any one of five different positions along the top of the card. Terms for guidance in consultation are typed on these tabs and are readily seen. Every card or set of cards filed under a given concrete term is preceded by a buff guide card having that concrete term typed on its projecting tab which in this case occupies the top left hand corner position. When the number of cards filed under that concrete term increases and cards bearing names of countries appear, a guide card having the tab in the middle position is inserted before each sub-group of cards for the various countries and bears on the projecting tab the name of the country. Also when the cards under a given concrete term become numerous, it is advisable to insert at intervals other guide cards having the projecting tabs in the top right hand corners and bearing on these tabs the "process" term of the card which they precede.

Nitro-
glycerin

=Glonoin Oil
=Glyceryl tri-
nitrate

–N/C propell- –Solution
ant Explosive

Liquid Explos-
ive Compound

Impure —

Frozen —

We are concerned at present mainly with the functions of the "main guides," *viz.* those preceding the whole of each set of cards filed under a given "concrete" term, and shall content ourselves with remarking that "country guides" and "process guides" serve mainly to facilitate scrutiny of the groups in which they themselves appear. The main guides have much more important work to perform. It is by means of these that the consulter of the index, having exhausted the possibilities of the group filed under the term appearing on the top left hand corner of the guide, proceeds to other terms in the index related to that first consulted. These other

"related" terms are typed in alphabetical order on the main guide card. A specimen main guide card is given in the preceding column in order to make the description clearer.

On this main guide card we have first of all the synonyms of the term nitroglycerin, *viz.* glonoin oil and glyceryl trinitrate. Then there are terms in which the word nitroglycerin appears first, *e.g.* nitroglycerin nitrocellulose propellant explosive, and nitroglycerin solution. Then there are higher collective terms, *e.g.* liquid explosive compound, and lower, more specific terms, *e.g.* impure nitroglycerin, and frozen nitroglycerin. If explosives are the main subjects of interest in an index it is advisable to draw up as sound a scheme of classification of explosives as is possible and to allocate the name of each explosive to its appropriate position in that scheme, the position being indicated on the main guide card. This scheme is now being introduced into the index at Ardeer Factory.

We return once more to the question of treatment of the weekly collection of cards. As was mentioned above, these are scrutinised in connexion with "related terms" at the time that the process section is being dealt with. A card having for "concrete" a term filed previously may contain matter which necessitates a fresh entry or two in the process section or a fresh connexion as regards "related terms," but many of the cards of this type will require no further treatment and are placed in position in the drawers of the cabinet above the rod as explained in the case of cards bearing proper names and names of firms. There remain now all cards bearing terms not filed previously, that is new concretes. Buff coloured main guides are made for each of these, and on every main guide are entered the synonyms, higher collective terms and lower specific terms appropriate to each case. At the same time cross references are entered on main guides affected which have been filed previously. If the term nitroglycerin is referred to "liquid explosive compound" then on the guide for "liquid explosive compound," which must be inserted if it has not been filed previously, the term "nitroglycerin" is typed. It will be noticed, by the way, that guides will appear in the index which have no cards behind them bearing the same concrete. Again if the term "glonoin oil" is entered on the "nitroglycerin" guide, "nitroglycerin" is entered on the guide for "glonoin oil," etc. Then as regards literal connexions, if the term consists of two or more words, *e.g.* "colloidal nitroglycerin nitrocellulose powder" the guide for powder may be selected and on this the entry "colloidal nitroglycerin nitrocellulose — " would be made. An alternative procedure which is to be preferred in many cases is to connect a quadruple term like this in two or more stages, *e.g.* first to "nitroglycerin nitrocellulose powder" on the guide for which "colloidal — " would appear. The further connection of "nitroglycerin nitrocellulose powder" to "powder" on the guide for which "nitroglycerin nitrocellulose—" would be entered would probably meet requirements.

It remains to mention that five years' working of the Central Index necessitated the use of three sixty drawer cabinets. The Dictionary Catalogue occupied in the same period one sixty drawer cabinet. The library staff comprises two chemists, acting as librarian and indexer respectively, one assistant chemist, who acts as assistant indexer, and eight typists. Four of the latter are employed in work connected with the index. The remaining four are occupied in typing reports, etc.

The author's thanks are due to Nobel's Explosives Co., Ltd., and to Mr. William Rintoul, Manager of the Research Section, Ardeer Factory, for permission to contribute this account.

NEWS FROM THE SECTIONS.

NEWCASTLE.

To the January meeting, which was of an informal nature, the members brought exhibits of apparatus and other objects of interest. Mr. O. Smalley showed specimens of charcoal blocks made from fine material which had been agglutinated with non-sulphurous binding material; and he also exhibited a portable punch hardness-testing machine, which was but little larger than a black-lead pencil. Two forms of Forster base-metal pyrometer were shown and explained by Mr. C. Patterson and Dr. J. H. Paterson, respectively; the latter also exhibited a Pointolite lamp and a microscope for micro-metallurgical work with a special illuminating device. Mr. W. S. Coates raised considerable interest in demonstrating the probable causes of boiler-tube failures, including bursts, corrosions and pittings, a large number of specimens being shown. The Michell viscometer, an Australian instrument which is shortly to be made in this country, was exhibited by Mr. H. T. Newbigin. Mr. A. Trobridge brought some specimens of soda crystals which he had collected at Lake Magadi in British East Africa, and of calcined soda prepared therefrom; he also gave an account of his travels in that colony. Other exhibits included a modified Jones Reductor, by Mr. G. Weyman; graphite made in an electric furnace, by Mr. J. C. Shenton; and flue dust and potash products, supplied by Mr. E. Bury of the Skinningrove Iron Co.

Dr. F. C. Garrett announced that as the result of a recent meeting of the Section and of the appointment of a small committee to inquire into the formation of a local chemists' club, suitable rooms had been found in Brunswick Place, Newcastle. It was decided to circularise all the chemists in the district with a view to obtaining support for the project.

LIVERPOOL.

A meeting was held jointly with the Liverpool Geological Society at the Royal Institution on January 14, when Mr. H. W. Greenwood delivered a paper on "Geo-Chemistry, its Problems and Potentialities," the President of the Geological Society of Liverpool (Dr. J. C. Given) being in the chair.

During the last four years more attention has been paid to geo-chemistry in this country than during the 20 years prior to 1914, owing to exigencies arising out of the war. Geo-chemistry might be said to deal chiefly with inorganic materials, *e.g.*, potash and its sources, silicates, refractories, rare earths, etc. The Phase Rule is of great importance, and is involved in problems of salt formation and generation of silicate systems from molten silicates in the earth's crust. In this subject, as in others, research pays, and America leads the way, as shown by the good work done in the Geophysical Laboratory of the Carnegie Institute, Washington, and by the U.S. Geological Survey.

England, relying in the past on her natural deposits of coal and iron, has used these lavishly and must now efficiently survey her natural mineral resources, and by investigation and research into mining and smelting put these industries on a more scientific basis. If the necessary steps are taken to establish Mr. K. Chance's process for the recovery of potash, it should be possible for this country to be self-supporting in regard to this material after a few years. Although in England there is a good knowledge of furnace materials and their uses, little work has been done on refractories for the highest temperatures, as required in electric furnaces; further research is necessary before we

can obtain the temperature-control which will be required in furnace work in the future. The cement industry offers many problems which might well be investigated from a geo-chemical standpoint; the properties of cement depend on properties of such a phase system as $CaO—SiO_2—Al_2O_3$, the equilibrium relations of which (at different temperatures) must be known. A works in Germany has recently commenced making cement and sulphuric acid from gypsum; in England there should be a good prospect of making arsenic-free vitriol by this process from our deposits of gypsum and anhydrite. There is a big field of research in discovering methods of working poor ores and reworking "residues," and scientific surveys might bring fresh sources to light.

In the future coal must be (universally) carbonised in the most economic fashion so as to give the maximum yield of high-grade gas, fuel oil and other important by-products, and coke which can be efficiently burnt to give electrical energy. Peat and lignites and the possible existence of petroleum deposits in this country are other fields of interest open to the geo-chemist. Rare metal ores are nearly all imported, yet there must be large quantities of tungsten, uranium, titanium, etc., combined in minerals in this island, but up to now they have not been considered as available for "working" on account of the very small proportions in which they occur in our rocks. Rutile, tourmaline, monazite, etc., occur in sandstones from Yorkshire and the Midlands, but in small quantity—nearly always less than 1 per cent. In the processes of treating, dressing and grading these sands for the glass and ceramic industries, it might be possible to introduce methods of separating the heavier rare earth portions by electro-magnetic, electro-static, or pneumatic means.

In conclusion, geo-chemical research and adequate geological survey are national necessities for the future; there must, therefore, be suitable inducement offered to our professors and lecturers, as well as to our young men who might wish to make geo-chemistry their profession. It must also be borne in mind that a scientific or technical department should be under the control of a scientific and technical head and not a legal gentleman or a classical scholar—if we wish to progress on the right lines.

NOTTINGHAM.

Dr. A. D. Denning gave an address on "The Factory Manager after the War" at the meeting held on January 22, with Mr. F. H. Carr in the chair.

At the present time there is a growing conviction that industry is a branch of national service, and that it must be conducted from this point of view. The industrialist will be well advised to embrace this ideal, since collectivism, in some form or other, was sure to come either voluntarily from within or by State compulsion. The emotion of a strong ideal was needed to produce efficiency, as well as to dignify industry, which was still to some extent open to the reproach made by Ruskin, that while men of other professions made service their principal aim, that of the industrialist was profit.

The lecturer showed how efficiency of production could be increased by a scientific analysis of functions, and by the distribution of activities in accordance with this analysis. The manager should be regarded primarily as a strategist co-ordinating and regulating the activities of others. Most businesses are out of adjustment in some way, it may be from the manager's partiality for the activity in which he won his spurs, or from a general lack of organisation. When proper organisation has been secured, the manager in his capacity of strategist must ever be trying to "sense" the problems ahead. The qualities required of a good manager vary somewhat with the size of the business. In a small business, knowledge of material is the more important; in a larger, knowledge of men; and in the largest of all, abstract thought, the ripe fruit of experience. In the very largest industrial units administrative power is of the very first importance, and technical skill occupies a minor position. The great administrators and captains of industry were usually not trained experts in the first place, but possessed this administrative power. An "Institute of Efficient Managers" was suggested, which would grade its members and deal in a summary manner with those who, by their mistakes, fostered labour troubles and brought the present system into disrepute. A chart was shown on which functions in a factory were classified and sub-classified. Thus the sub-section "employment" is in the section "comparison," which is a part of the "facilitative" function, intermediate between production and distribution. This sub-section is one of the most difficult and important. We have been very casual in the selection of men for definite posts, and some improvement might be effected by the appointment of specialist "employment managers." There are now courses for the training of such managers at six universities in the United States. In another chart the different aspects of work, *e.g.*, consultative, determinative, etc., are plotted against specific parts of factory work, *e.g.*, design, equipment, etc., and it was shown how each employee could be fitted into one of the squares thus formed.

The lecturer also touched on the proper use of works committees (consultative only), chart rooms in factories (to convey information at a glance), the possibility of kinematograph demonstrations to the workers (showing output, etc.), and standardisation of production and fatigue studies.

A discussion followed.

LONDON.

At the meeting held on February 3, the chairman, Dr. Charles A Keane, explained that the Committee had considered that a useful purpose might be served if from time to time collaborated accounts of various subjects of importance in chemical work could be considered at a single meeting, and with that object in view it had been arranged to devote the evening to the subject of "Refractometry and its Applications in Technical Analysis."

Prof. J. C. Philip, after referring to the value of the determination of physical constants in identifying compounds or in establishing their purity, gave a very clear and concise account of the physical principles underlying the construction of refractometers. By means of diagrams he showed the paths of the incident and refracted rays in the prisms of the Hele, "Dipping," Abbe, and Pulfrich instruments. For accurate measurements monochromatic light should be used, but in most instruments its use is obviated by the introduction of a "compensator" whereby ordinary composite light can be employed. Due regard must always be paid to temperature control, as variations cause considerable differences in the refractive indices of substances examined.

Mr. Stanley gave an account of improvements which have been introduced in the Abbe refractometer. During the past few years his firm has had a number of these instruments for repair and has come to the conclusion that no advances have been made in the construction during the past 25 years. Among the improvements, dense flint has been substituted for crown glass in the prisms and the prism-box has been made to open away from the observer. A slow motion adjustment has been

provided for the reading arm, and in the new instruments of the "Dipping" type the prisms can be easily removed for cleaning.

Mr. Simeon also emphasised the importance of temperature in measuring refractive indices, and explained some of the means that have been taken to ensure control of accuracy of the parts of the instruments. To secure uniformity in the glass used for the prisms, portions of every rough piece of glass received are taken, ground flat and cemented together by a special process, and the composite block obtained examined by a sort of interferometer method. Great care is also necessary in the graduation of the arc itself.

Among applications of the refractometer, Mr. Main explained that the refractive index of sugar solutions can be used to determine the water content, and this method is much more expeditious than, and as accurate as, the determination of the specific gravity which was formerly employed. Mr. Berry gave an account of the use of the instrument in the examination of chlorhydrin, which can be determined far more easily in this way than by purely analytical methods, and this application has proved of great value during the war. Miss A. Homer described the work done in the concentration of sera, which has also been a serious problem during the war, and the use of the refractometer has saved an enormous number of protein determinations, which by the ordinary gravimetric process would have been quite impracticable under recent conditions. Mr. Bolton gave a clear idea of the value and limitations of the refractive index in the examination and identification of oils and fats, and also drew attention to the necessity of always recording the temperature at which the observation is made and urged that 40° C. should be adopted as a standard temperature. He also drew attention to the desirability of a "continuous-reading" instrument being devised.

MEETINGS OF OTHER SOCIETIES.

THE FARADAY SOCIETY.

The General Discussion on "The Present Position of the Ionisation Theory," held on January 21 in London, attracted contributions from Prof. S. Arrhenius, Prof. S. F. Acree of America, and from a large number of workers in this country.

Although the ionisation theory has now secured general acceptance, there are still many unsolved problems in connexion with the nature of solutions of electrolytes. Among these may be mentioned the question of possible association between solvent and solute, the reason why strong electrolytes do not follow the law of mass action, the question of the mechanism of ionisation, and the relative chemical reactivity of non-ionised molecules of electrolytes and their ions.

Some workers, including Mr. W. R. Bousfield, who contributed two papers to the discussion, consider that most of the remaining difficulties regarding electrolytes can be accounted for on the assumption that ions (and also non-ionised molecules) are associated with the solvent. On this view the cause of ionisation is to be found in the affinity of ions for the solvent, the energy required for ionisation coming from the heat of hydration of the ions. Bousfield proceeds to calculate the average hydration of the ions in an aqueous solution by regarding them as small spheres moving at a steady rate through the solvent water, and applying Stokes's law to find the radius of the complex (ion plus associated water molecules), which is then compared with a probable value for the radius of the water molecule. Dr. H. Sand, in a contribution to the discussion, shows that Bousfield's method leads to a value for the volume of the hydroxyl ion which is only about one-thirtieth of that obtained by other methods, and he concludes that Stokes's law does not apply to particles of molecular magnitude. For this and other reasons, very little confidence can be placed in the work so far published on the extent of the association between solvent and solute. Further, for a reason given in the next paragraph, it is improbable that an adequate explanation of the mechanism of ionisation can be based on assumed association between solvent and solute.

Although the second difficulty mentioned above, the deviation of strong electrolytes from the law of mass action, has not yet been fully accounted for, the recent careful conductivity measurements of Washburn and Weiland, who used as solvent "ultra-pure" water of specific conductivity 0·05—$0{\cdot}07 \times 10^{-6}$ reciprocal ohms, promise to throw considerable light on the subject. Their results show that in the case of solutions of potassium chloride the law of mass action is followed from 0·00002 molar to 0·00007 molar; from 0·00007 molar to 0·001 molar the dissociation constant K increases regularly with increasing concentration. The fact that the deviation appears in such very dilute solutions is very interesting, and is difficult to reconcile with any explanation based on association between solvent and solute. For the same reason it is improbable that the formation of complex ions can be adduced in explanation of the phenomenon. Moreover, Dr. J. W. McBain and Mr. F. C. Coleman, in an important contribution to the discussion, show that other suggested explanations of the problem of strong electrolytes, due to Arrhenius and to Walden, are not in accord with the experimental facts. Further progress on this subject is likely to be attained on the experimental side from the prosecution of conductivity determinations with specially purified solvents, and on the theoretical side from an examination of the nature of interionic forces and of the forces between ions and undissociated molecules.

It is now generally admitted that both non-dissociated molecules and their ions may be chemically active, and illustrations of this view were given in papers by Dr. G. Senter and by Prof. Acree contributed to the discussion. Further investigation of the relative activity of ions and non-ionised molecules promises to throw light on the nature of chemical action in general.

THE INSTITUTION OF CIVIL ENGINEERS.

On January 28 last, the Hon. R. C. Parsons read a paper on "Centrifugal Pumps for Dealing with Liquids containing Solid, Fibrous, and Erosive Matters."

The first part of the paper was devoted to an account of the author's "Stereophagus" pump which was designed some seven years ago for use in sewage-disposal works. Although this pump has proved very successful in dealing with liquids containing fibrous and solid matters, it appeared to be possible to construct another type of pump which would be more suitable for dealing with liquids of a corrosive nature. The result has been the designing of the Flexala pump, which, as its name implies, has flexible vanes. This pump is of the ordinary single-inlet centrifugal type. The impeller consists of a cast-iron centre, the boss of which screws on to the spindle of the pump: in one with this boss is a flat-circular plate, on to the surface of which is vulcanised a layer of pliant rubber, and out of it spring the curved rubber blades of the impeller. This impeller is in close proximity to the centre face of the cover of the pump, and in this face spiral grooves are placed in the direction of the track of the water passing

through the impeller. This face may also be coated with rubber, and in cases where the erosive action is very marked, or where the liquid is of a very corrosive nature, the whole of the internal surface is lined with rubber.

In both the Stereophagus and Flexala pumps the impeller is provided with the usual balancing vanes at the back, but in addition to these an automatic balance is obtained by the admission of a small quantity of air into the pump when in operation, which causes the centrifugal action of the vanes at the back of the impeller to equal that of the vanes at the front, through which the head of the pump may vary.

A large number of Flexala pumps have been constructed and have yielded satisfactory results.

SOCIETY OF PUBLIC ANALYSTS.

The annual general meeting was held in London on February 5. After Dr. S. Rideal had delivered the presidential address, he announced the names of those who had been elected to serve on the Council during the ensuing year. Dr. Rideal was re-elected president.

At the ordinary meeting which followed, Mr. D. Pullman described a method for the "Recovery of Nessler Solution," by which the whole of the mercury and iodine is recovered from the used solution by the addition of a soluble mercury salt to the neutralised residues. The mercuric iodide thus obtained is converted by means of metallic zinc into zinc-mercuric iodide and mercury. The double salt, with the addition of sodium hydroxide, forms an efficient nesslerising reagent, whilst the mercury is dissolved in nitric acid and used to precipitate further residues.

Mr. J. Allan then contributed a paper on the "Technique of Iodine Determination," in which he described the sequence of the operations comprised in the determination of the iodine value of oils, and the method adopted by him for carrying out a large number of determinations in a minimum of time. In a supplementary note he described "A New Machine for Sub-dividing Oleaginous Seeds," the chief merit of which was its capacity for delivering a product particularly well suited for subsequent treatment in analysis.

ROYAL SOCIETY OF ARTS.

On February 5, Mr. S. C. de Segundo read a paper on "The Removal of the Residual Fibres from Cotton-Seed and their Value for Non-Textile Purposes."

Owing to the recent introduction of mechanical devices for recovering the residual short fibre on cotton-seed, which escapes the action of the gin or other saw-linting machines, one of the world's most abundant natural products, hitherto neglected, has been rendered available for industrial purposes in the manufacture of explosives, paper, artificial silk, and other cellulose derivatives. Probably over 95 per cent. of the 11,000,000 tons of cotton-seed annually produced is of the white (or woolly) variety, from which residual fibre is recoverable.

The superior character of the products obtainable by the American system of crushing the kernels alone, as compared with the British system of crushing the seed in its entirety, was dealt with, and it was pointed out that from the residue of the kernel, after extraction of the oil on the American system, a valuable and highly nutritious flour is prepared in the United States, which is practically starch-free and contains over five times as much protein and fat as wheat flour, and has been officially recommended by the United States Government as a diluent for wheat. Also a higher percentage extraction of oil from the seed is obtainable by the American method.

Statistics relating to the Indian cotton-seed crop show that the products obtainable from an average crop, if wholly employed in the production of oil and cake, and if the residual fibres are turned to account, should be worth, on the basis of pre-war values and after deduction of all manufacturing expenses, about £7 per ton of seed as compared with about £3 per ton, the estimated value of the seed hitherto obtained. This represents a potential increase in revenue of about £6,000,000 per annum.

During the lecture a machine removing residual fibre from Indian cotton-seed was shown in operation; and there were also exhibited a sample of cotton-seed flour, loaves of bread made with a mixture of cotton-seed flour and wheat flour, and samples of paper, artificial silk and vulcanised fibre manufactured from the residual fibre. (See also this J., 1918, 132 R, 118 T.)

PERSONALIA.

Dr. T. A. Henry, Superintendent of the Laboratories at the Imperial Institute, has been appointed Director of the Wellcome Chemical Research Laboratories in succession to Dr. F. L. Pyman.

Mr. R. G. Perry, chairman of the board of Messrs. Chance and Hunt, Ltd., and Messrs. C. F. Chance and D. A. Bremner, directors, have resigned their positions.

The Institution of Civil Engineers has elected upon its roll of distinguished honorary members Marshal Foch, Field-Marshal Sir Douglas Haig, and Admiral Viscount Jellicoe of Scapa.

The Admiralty announces that Mr. W. McClelland has been appointed Director of Electrical Engineering in succession to Mr. C. H. Wordingham.

Mr. George Martineau, C.B., an authority on the subject of sugar in its economic aspects, died on February 5, aged 85.

Dr. W. Marshall Watts, an investigator in the field of spectroscopy and author of valuable contributions to its literature, died last month in his seventy-fifth year.

Sir A. Strahan, Director of the Geological Survey, and Engineer Vice-Admiral G. G. Goodwin have been elected honorary members of the Institution of Petroleum Technologists.

Dr. A. E. Dunstan and Dr. W. R. Ormandy have been elected members of the Council of the same Institution.

Dr. F. G. Cottrell has been awarded the Perkin Medal of the New York Section of the Society of Chemical Industry for his distinguished services in applied chemistry. Dr. Cottrell, whose name is identified with the electrostatic process of separating suspended solids from gases, is now chief metallurgist of the United States Bureau of Mines.

The death is announced from Cape Town of Dr. G. S. Corstorphine, the well-known geologist and Principal of the South African School of Mines and Technology. Dr. Corstorphine was the first Professor of Geology and Mineralogy in the South African College, and did much valuable work in connexion with the mining of gold and other minerals in South Africa.

The residue of the estate of the late Mrs. Purdie, widow of Prof. T. Purdie, was bequeathed by her to the University of St. Andrews for the promotion and maintenance of post-graduate research scholarships in chemistry. The monetary value of the bequest is about £25,000.

NEWS AND NOTES.

CANADA.

Oil Concession in Alberta.—A recent despatch from Ottawa states that the Government is considering a proposal to concede to the Shell Transport and Trading Company, Ltd., the right to enter upon and develop all the oil-bearing lands in the Province of Alberta north of the Athabasca River. This concession is to be in the nature of a monopoly for five years, except in so far as the rights of leaseholders and prospectors already on the ground are concerned. In return, the company is to pipe the oil to Vancouver, or to the head of the lakes, and after receiving six per cent. on its investment is to divide the remaining profits equally with the Government.

Acetic Acid.—Among the many new industries which have been developed in Canada during the war, none has attracted more interest than the development of the process used by the Canadian Electro Products Co., Ltd., at Shawinigan Falls, Que., for the synthetic manufacture of acetic acid. Although much has been written during the last two years regarding this plant and process, a brief summary may not be out of place.

The process consists of (1) the conversion of acetylene gas to acetaldehyde in the presence of sulphuric acid and a mercury salt. The acetylene gas used in this process is generated at what is probably the largest generating station in the world. 2. The conversion of the acetaldehyde to acetic acid by oxidation in the presence of a catalyst. 3. The catalytic decomposition of glacial acetic into acetone.

In each process the crude materials are carefully distilled, so that only pure products are used for the next step, *i.e.*, refined acetaldehyde is used for the manufacture of acetic acid, and the glacial acid is used in the final process.

One of the most striking features of this new process is the fact that glacial acetic acid of over 99 per cent. strength is obtained from the stills on first run, thereby assuring quick and economical production.

Another feature is the purity of the crude acid obtained by this process. This crude acid does not contain any of the impurities which are always present in the crude acid made by the wood distillation process. It is quite free from sulphuric acid, tar, or resinous matter, and is absolutely water white in colour. Such purity is a decided advantage in the manufacture of colours, etc., and also when used in dyeing. It has been found by actual experience in several colour manufacturing plants and dye houses that the results obtained by the use of the crude acid made by this process are decidedly superior in many ways to the results obtained by the crude acid previously used. In every case the colours have been brighter, shades and tints truer and more easily duplicated, and the results have in every way been more uniform. These results are due not only to the purer quality of the crude acid, but to its absolute uniformity.

Two plants were erected for the manufacture of acetic acid by this process, each plant having a capacity of approximately 700 to 800 gross tons of glacial acid per month. One of these plants has been in operation since 1916, and has proved beyond doubt that the process is commercially successful.

Much research work has been undertaken by the chemists responsible for the development of this process, with a view to developing other synthetic materials. These investigations have proved that many other commonly-used organic products can readily be made "synthetically" from the acetylene base, and intermediate products made available in the manufacture of acetic acid. It is quite possible that at least some of the following products will be manufactured synthetically at no distant date:—Alcohol, acetic anhydride, acetylene tetrachloride, chloral hydrate, chloroform, dichlorethane, ethyl acetate, formaldehyde, monochloracetic acid, and paraldehyde.

Many of the chemicals mentioned above are now being made synthetically from acetylene in Europe, particularly in Switzerland, France, and Germany. While there is no doubt a certain similarity in the different developments in these various countries, those responsible for the Canadian undertaking feel certain they can meet foreign competition in this field, owing to many advantages their process has over any similar development elsewhere.

The production of synthetic chemicals is a new addition to the industrial life of Canada, and while it is as yet in its infancy it is expected to develop quickly into one of Canada's industrial giants.

Owing to the favourable location of the plant at Shawinigan Falls, which is the electro-chemical centre in Canada, and to the Company's connexion with the Shawinigan Water and Power Co. and the Canada Carbide Co., the future supply of raw material is assured. This industry, therefore, looks forward to the return of normal times with every confidence of success and further expansion.

SOUTH AFRICA.

Industrial Developments.—At Dornfontein (Transvaal) a firm is producing caustic soda of over 90 per cent. quality, and after certain improvements to the plant have been effected the output is expected to reach 1 ton per day. Washing soap and Epsom salts are also being manufactured. In addition to manufacturing anhydrous ammonia for refrigerating plant, a Natal firm is undertaking the production of hydrogen peroxide.

Oil from Mgongo Nuts.—The Imperial Institute has recently reported upon the oil of Mgongo nuts, which grow plentifully in Northern Rhodesia and which are said to be identical with the Manketti nuts of South-West Africa formerly exported to Germany for the extraction of the oil content. The true kernels, states the report, with the seed-coat removed, yield 58·1 per cent. of oil (Manketti nuts, 57·2 per cent.), equivalent to 37·8 per cent. of oil from the entire seeds. In view of the fact that the seed-coat could not be satisfactorily removed by mechanical means, and that therefore it would be necessary to crush the whole seed to extract the oil, it is considered unlikely that the nuts could be utilised for this purpose on a commercial scale.—(*S. Afr. J. Ind., Oct.*, 1918.)

UNITED STATES.

Patents.—The question of patents assigned to the public is again receiving attention. Since 1883 such patents, principally taken out by Government employees, have been thrown open, with the result that no one cared to invest the money required for development, as there would be no protection. One plan now proposes leaving all rights with the patentee, excepting that the Government and its licensees shall have free use of the patents. The other contemplates empowering the Federal Trade Board to control patents assigned to the public, license their use and expend the fees in development work and rewarding the patentee.

Glycerin from Dextrose.—The war has been instrumental in furthering the development of a process for making glycerin by the fermentation of dextrose or sucrose. It is stated that about half the sugar is converted into glycerin and the remainder into alcohol. The recovery of the

glycerin economically presents some technical difficulties which are said to have been overcome in the large plant in Illinois. One of the big powder companies is putting in a commercial unit. The price of glycerin has fallen from about 57 cents to 16 cents per lb. since the armistice was signed, and soap makers have said it would help them if glycerin became so cheap that they would not be required to recover it. The process comprises nearly two-thirds of their labour of manufacturing.

The Government Chemical Factories.—An effort is being made to co-ordinate all the researches undertaken by the War Department, and the future of the Government-owned chemical plants is being actively discussed. The great nitrate plants have been in operation in complete units although the entire plants have not been worked. The same applies to the cyanide plant. Several installations are being taken down and carefully stored pending decisions on future policy.

The American Chemical Society.—An unusually important meeting of the Council of the American Chemical Society was held on December 14 at which questions of reconstruction were discussed and various committees appointed. The matters acted upon included:—The question of co-operation with England in the work of compiling a compendium of chemical literature in English: approved, and report from committee appointed to be heard in the spring. Formula index for "Chemical Abstracts": approved. It was recommended that the duty-free privilege for schools in regard to chemicals and apparatus be abolished. Steps were taken to secure better co-operation between universities and industries. Federal aid for research was approved. The metric system was shown to be of material aid in foreign commerce and its early introduction throughout the country was urged. To the Advisory Committee of the Society was detailed the careful consideration of the future research work of the War Department, the complete compilation of data and records of the work of the Chemical Warfare Service and the publication of this material in so far as it is of no military value.

New Process for Making Parabolic Mirrors.—One of the great factories entirely devoted to war work has succeeded in making satisfactory parabolic mirrors by chemical processes thereby saving time and reducing weight. A highly polished glass mirror formed the pattern. Silver was deposited chemically, the layer increased electrolytically, $\frac{1}{16}$ in. copper added by a special plating method, and this backed by a suitable thickness of a cementing material. The difference in expansion between glass and metal served to separate the metallic portion from the glass mould, after which the silver surface was protected with a waterproof, chemically-prepared lacquer capable of withstanding the necessary temperature. Such mirrors gave satisfactory results, and they can be made very quickly as compared with grinding and polishing glass. The mountings required were also much lighter.

Federal Aid for Scientific Research.—The benefits of research have been emphasised to such an extent by the war that much interest is being shown in Federal aid for research. It is proposed that $15,000 be spent the first year in each State, to be increased by $5000 annually until $30,000 is reached, and continuing then at that sum. The money would be expended under the direction of a board in each State in whichever institution was found to be best equipped for the work. A central body would correlate the research, advise, publish and exercise general supervision without actually directing the work. Its secretary would be changed annually, giving way to the assistant secretary, so that continuity could be secured together with the advantages of an ever new view-point

JAPAN.

The Vegetable Oil Industry of Kobe (Japan).—The process of crushing seeds for oil has been in use in Japan for centuries, but it is only in recent years that the production of vegetable oils has been sufficiently large to allow of a big export trade. The real prosperity of the seed crushing industry may be said to have only commenced during the war, when the world shortage of oils raised prices. Kobe is the centre of the industry and is admirably situated as regards shipping facilities and labour supplies. While there has been a lack of tonnage all over the world, the Japanese have maintained their steamship lines to practically all the Far East ports, and Kobe has been supplied with copra from Singapore and Java, soya beans from Dairen and Vladivostok, peanuts from Tsingtao, cotton seed from Tientsin and Shanghai, rape seed from Hankow and India, and castor beans from China and India. The resulting oils have also been shipped direct to all parts of the world. The output of oils from the Kobe district is now about 5700 tons per month divided approximately as follows:—Soya 2100 tons, coconut 1700, rape seed 1400, cotton seed 500, but the proportions vary with the quantities of raw materials available. The variety of raw materials is a great advantage as the mills can be turned from one product to another, generally with little alteration, to meet special demands or to fit in with the seasons of the various plants, and are thus kept continuously at work. The mills vary in size from a productive capacity of 10,000 to 360,000 gallons per month, they are all situated on the coast and all except one use the pressure system, the one exception uses the benzine extraction method. The pressure processes are very similar to those used in America. In the round type hydraulic press the amount of oil extracted at each crushing is generally small, and as many as 3 or 4 operations are necessary with copra and peanuts. The flat bed rectangular presses give a higher yield of oil per crushing but the oil needs more refining. One plant is using the latest type of rotary screw expeller mill with great success. The benzine extraction process is at present suffering from the high cost of spirit. The Japanese mills clarify the oils by filtration, but do not remove the free fatty acids. The war has created an enormous demand for castor oil as a lubricant for aeroplane engines and the production has been increased to the limits of the available supply of castor beans. Perilla oil obtained from the seed of an Asiatic mint (*Perilla ocymoides*) is made in considerable quantity; it is a drying oil used largely in Japan as a substitute for linseed oil. This product should become better known.

The oils are generally shipped from Kobe in secondhand tins which have previously been used for kerosene or petrol. This usually entails a leakage loss of about 5 per cent., but the use of more efficient and costly packages such as barrels and drums is prohibited by the high freights for returned empties, whereas the old petroleum tins are not returnable. Attempts to use tank steamers have so far failed owing to the want of large storage tanks and pumping machinery.

The general outlook of the industry is good although it is thought in some quarters that the apex of prosperity has been reached. One very important factor is the sale of the pressed cake, and, generally, Japanese mills have been able to dispose of their output locally, but occasionally mills have had to close down owing to the low price of cake. The importance of oil cake prices is shown by the fact that at the June prices of

this year, 70 per cent. of the proceeds realised from soya beans came from the cake and only 30 per cent. from the sale of the oil. (See also this Journal, 1918, 439 R.)—(*U.S. Com. Rep., Oct.* 30, 1918.)

Investigations of Vegetable Dyes in Japan.—The British Consul in Shimonoseki reports that as a result of investigations instituted by the Department of Agriculture and Commerce, some sixty varieties of trees and twelve varieties of plants have been found to have value as raw material for dyes. Some of these are enumerated below:—

Pinus densiflora (Japanese: Aka-matsu).—The leaves of this tree, found throughout Japan in a wild state, yield a dark brown dye used for cotton yarn. *Pinus Thunbergii* (Kuro-matsu).—This common variety of pine gives a dark dye which may be extracted as follows:—10 parts of fresh leaves are added to 3·3 parts of sulphur and ten parts of sodium sulphite and the mixture heated with water for five hours. The resulting dye commands a ready sale. *Chestnut* (Kuri).—Treated with copper sulphide, the bark yields a dye for saddlery wares. The leaves and bark yield a black dye for silk, and the root a yellow dye for staining furniture. *Quercus dentata* (Kashiwa).—A decoction of the bark gives a material used for dyeing hemp, cotton, etc., a khaki colour. *Quercus serrata* (Kunugi).—The fermented leaves yield both brown and deep green dyes. *Pomegranate* (Zakuro).—The bark of this tree gives a leather dye. *Pasania cuspidata* (Shii) yields a dye used on fishing nets. *Camellia Japonica* (Tsuboki).—The leaves when pressed yield a green which is used for dyeing cheap mosquito nets. *Myrica rubra* (Yamaromo).—The juice extracted from the leaves and bark gives a dye for fishing nets, also a priming for indigo dyeing, and is used for dyeing khaki uniform cloth. *Eleurites cordata* (Abura-giri), *Quercus-Gilve* (Ichii), Pagoda-tree (Enju), *Juglans Sieboldii* (Onigurumi), *Raphiolepis Japonica* (Sharimbai); and several other trees yield dye material from their leaves, bark or roots. The following plants also yield dyes of value:—*Swertia Chinensis* (Senburi), *Lespedeza pilosa* (Neko-hagi) and *Coptis* (Oren).—(*Bd. of Trade J., Jan.* 9, 1919.)

GENERAL.

The Imperial College of Science and Technology.—At a meeting of past and present students of the Imperial College, held on January 29, it was resolved, with but one dissentient, to forward a petition to the governors of the College urging them to take immediate steps to raise the College to the rank of a university, distinct from the University of London, with power to confer its own degrees in science and technology. The petition states that in the past the Empire has suffered from lack of men and women trained in the methods of science, and particularly in the application of scientific principles to industry: that public interest needs to be stimulated at the present time when, owing to the war, there has arisen a dearth of trained students; and that the creation of such a proposed Imperial University of Technology is needed to meet the ever-increasing demands of industry for men trained efficiently in scientific and technological work. Up to the present, students of the College who wished to obtain university degrees have had to enter for external examinations, and this has entailed the expenditure of much energy, without improving their knowledge or powers of research.

Destruction of Opium.—A Reuter telegram from Shanghai of January 21 last, states that one-half of the opium stocks purchased by the Chinese Government in 1918 has been burnt by order. The balance will be burnt immediately. The value of the stock, if it could have been sold locally, would have been £5,000,000.—(*Scotsman, Jan.* 27, 1919.)

Proposed New Cyanamide Works at Workington.—The St. Helen's Colliery and Brickworks Co., Ltd., Workington, has been acquired on a cash basis of £12 for each £5 share of its issued capital by Nitrogen Products and Carbide Co., of which Mr. A. E. Barton is chairman. This company, it is stated, is to establish a works on the site of the old West Cumberland Works at Workington for the manufacture of cyanamide. Coal, limestone and cheap water supply are all near at hand in the district. Carbide will be an important product of the new industry, and the plant will provide for the working of all the by-products of coal. The works will need 3000 tons of coal per day, and turbines will generate 120,000 horse-power. A capital of £5,500,000 is involved. The works will take two and a-half years to complete and will ultimately employ 4000 hands.

Engineering Training Organisation.—Subsequent to the conference of engineers and educational workers held at the Institution of Civil Engineers in October, 1917, an organisation was formed with the object of promoting engineering training in its widest sense. A secretary, who must be a qualified engineer, is now to be appointed at a salary of £1000 per annum to take charge of its operations, which will include giving advice to parents and youths, encouraging employers to give full educational facilities to their pupils and apprentices, and co-ordinating the interests of different branches of the profession. The funds necessary for the support of the organisation are being supplied by voluntary contributions.

The Australian Chemical Institute.—Mr. C. P. Callister desires us to state that he is acting as representative in Great Britain of the above organisation, and that all Australian chemists now in this country who wish to have particulars concerning it should apply to him at: 6, Maiden Lane, London, W.C. 2.

Status of University Lecturers and Assistants.—At a recent meeting of the General Council of St. Andrews University, a report of the conference of General Council delegates of the Scottish Universities on the status and emoluments of lecturers and assistants was submitted. In moving the approval of the recommendations of that conference, Mr. J. Thomson said that for a long time lecturers and assistants had felt that they occupied a rather anomalous position in the University. Since the war began they had also felt that their salaries were quite inadequate, and they further desired representation on the administrative bodies. Professor Burnett seconded the motion, and pointed out that with the interruption of University work caused by the war, and the inducements the Civil Service were offering, it would not now be possible to get the kind of man they required for their higher teaching work at the old salary and the old status. The meeting approved generally the conference's recommendations, and instructed the clerk to convey its decision to the University Court.—(*Scotsman, Jan.* 27, 1919.)

Manganese in Egypt.—The Sinai Mining Co. made its first shipment of manganese-iron ore—4000 tons—to the United Kingdom in October last. The mines are situated in the south-west of the Sinai Peninsula, about 15 miles from the coast of the Gulf of Suez, and they are connected by rail for 11 miles and by ropeway for 6 miles with the port of Abu Zenima which is well equipped for storage and loading. According to the Egyptian Ministry of Finance, the average ore contains about 35 per cent. manganese and 23 per cent. iron;

large quantities of this grade are available.—(*Bd. of Trade J., Jan.* 16, 1919.)

Clays in Nigeria.—The Comptroller of Customs at Lagos has forwarded the following analysis of a sample of clay (used by the natives as a dusting powder) from Ozuakole, a village about 80 miles up the Eastern Railway in Nigeria:—Silica 47·4%, alumina 31·2%, ferric oxide 6·0%, lime 0·2%, water 10·55%, undetermined 3·75. This clay therefore closely approximates to Chinese kaolin.

Fire-clay of good quality has been discovered in the Udi coalfield, and is available to merchants in Nigeria or other Colonies at the following prices (f.o.b., in small quantities and exclusive of bags):—Port Harcourt 2*s.* 6*d.* per cwt.; Lagos 4*s.* 6*d.* per cwt. A copy of a report furnished by the Imperial Institute may be consulted at the Department of Overseas Trade.—(*Bd. of Trade J.*, Jan. 16, 1919.)

Minerals and Manufactures in Mesopotamia.—Little can be said about minerals in Mesopotamia, for little is known. The prospects of petroleum boring have attracted some attention. Petroleum was formerly imported almost wholly from Russia, but in 1906 Austrian and American low-grade oils obtained a footing and advanced in favour. Oil engines and oil lamps came more and more into use and consumption increased. Just before the war the development of the Anglo-Persian Company's oil fields naturally altered the situation, and Anglo-Persian oil promised to monopolise the local market unless petroleum was discovered in considerable quantities in Mesopotamia itself. A belt between Kirkûk and the Persian Gulf is certainly oil-bearing in parts, though production has not been attempted upon any scale. A large portion of this belt lies over the frontier in Persia. There are other belts on the Middle Tigris and on the Euphrates south of Hit, but the economic prospects in both cases are quite uncertain. Coal, lead and iron deposits exist in Northern Mesopotamia, and in the remote past gold was recovered in the Bohtar Valley.

The manufactures of Mesopotamia are few and primitive. Steam machinery was used in the military cloth factory at Baghdad, but the other industries may properly be classed as handicrafts. Milling, tanning, boat-building and brick-making are carried on for native supply, and there are a few luxury trades, such as silk weaving, metal working and the distilling of the spirit called araq from dates. The silk factories of Baghdad are famous, and the cultivation of the silkworm was at one time a flourishing industry. Tanning is a solid industry, though the methods are primitive, and bricks are made all over Mesopotamia. They are either used unburnt or burned in rough wooden kilns. When the Hindia Barrage was constructed the native method of making bricks was found to be the best and cheapest.—(*Bd. of Trade J., Jan.* 16, 1919.)

The Mineral Wealth of Montenegro.—It is probable that large mineral deposits exist in Montenegro. A very prolific vein of iron ore, which may well contain millions of tons, runs from Southern Dalmatia, *via* the Sutorman Pass, into Montenegrin territory. Coal has been found at Berane, mineral oil at Virpazar, and quicksilver near Ulcinj. During the war the prospects of this mineral wealth have much improved owing to the development of the roads. In future the Bocche di Cattaro will be the natural harbour of Montenegro.—(*Weltwirtschaftszeitung, Dec.* 6, 1918.

Kaolin Deposits in Bavaria.—In peace time Germany obtained the bauxite for her aluminium production from Southern France and Dalmatia. During the war geological investigations have shown the presence of valuable clay deposits, containing 35 per cent. of kaolin, at Tittling, Metten, Deggendorf, and Passau (Bavaria), but these clays contain more silica and iron than bauxite.—(*Z. des Ver deutsch. Ingen., Dec.* 7, 1918.)

Discovery of Graphite Deposits in Finland.—The graphite deposits discovered at Berttula in Tyrvis are, according to expert opinion, the largest yet found in the north. A company with a capital of 7 million marks has been formed to exploit them; and the necessary machinery has been ordered from Germany.—(*Hufvudstadsbladet, Dec.* 2, 1918.)

New Manganese Iron Field in Java.—The works established in Central Java, with a capital of 500,000 florins, to develop the manganese iron field there, is said to be meeting with great success, and, according to the *Soerabaja Handelsblad*, promises to prove a serious rival to the British Indian manganese undertakings.—(*Nieuwe Courant, Nov.* 27, 1918.)

The Alsatian Potash Works.—Seven of the fifteen works are in a position to produce. Four are entirely French, seven are German, and the remaining four are capitalised as to one-third by the Government of Alsace-Lorraine and two-thirds by Germany. Very little work has been done during the war and serious flooding has occurred in many parts. The Germans have carried off most of the workmen, and there is a shortage of labour.—(*Echo de Paris, Dec.* 28, 1918.)

Iron Ore Deposits in Russia.—The iron ores of the Governments of Rjäsan, Vladimir and Nijnii Novgorod are of high metallic content and very extensive. The deposits in Lipetsk in the Government of Tambov are exceedingly valuable and yield an excellent cast iron. Prospecting in the Alapajewer district of the Urals has disclosed the following ore reserves (in millions of poods):—Sinitschihinske group 400, Syrjanover group 1000, Alapajewer 1200, total 2600 million poods. Up to the present about 5 million poods has been produced annually (pood = 36 lb.). The average iron content of the ore is 45 per cent.—(*Z. angew. Chem., Nov.* 29, 1918.)

German Mining Operations in Serbia.—Among the discoveries made by German engineers in Serbia during the war were 10 deposits of metalliferous ore, 2 of magnesite and 1 of asbestos. At Pustenik, north-west of Elishan, experimental work was carried on for some months with a view to exploiting serpentine asbestos, but had to be abandoned owing to the smallness of the deposits.

In July, 1918, experiments were commenced on a bismuth deposit at Gradiste, 15 kilos. south of Kniazevac. In the then occupied area work could only be carried out with the chromium deposits of Gorantza and Grechane. The copper mines and smelting works at Bor were left to Germany by Bulgaria to work for the duration of the war. The chrome-ore mines at Uskub, situated in the Vardar Valley, were worked by Bulgarians, whilst the Plakalnitza-Elisseina Copper Mines and Works were operated under the authority of the Prussian War Ministry. Most of the copper ore was treated in a special furnace at the works.

The Probeda manganese mines at Posharevo were worked by the Bulgarian War Ministry, the Berlin Manganese Ore Co. supplying staff and materials for the purpose.—(*Z. des Ver. deutsch. Ingen., Dec.* 7, 1918.)

The Dannemora Iron Mines in Sweden.—The Dannemora mines supply hæmatite ore containing 59·2 per cent. of metallic iron, 1·59 per cent. of manganese, 0·0025 per cent. of phosphorus, and 0·056 per cent. of sulphur; nearly 80 per cent. of the ore is pure oxide of iron, and the minute traces of phosphorus, copper, arsenic, and zinc present are not sufficient to affect the quality of the iron. The sulphur is eliminated by roasting the ore, and

the high-class steel produced is chiefly due to careful treatment and the fact that no other fuel than charcoal is used in smelting. The ore is principally derived from open quarries situated below sea-level. One thousand gallons of water per minute is pumped from different points by means of electrically-driven centrifugal pumps. The deposits occupy about 32 acres, and the output is 53,660 metric tons per annum.—(*Teknisk Tidskrift, Nov.* 27, 1918.)

Tin in the U.S.A. in 1917.—During 1917 the United States imported 77,866 short tons of tin or 57 per cent. of the world's total output. This amount is the sum of two quantities, *viz.*, 72,166 short tons in metallic form and 5,700 tons estimated as recoverable from 9,054 tons of Bolivian concentrates imported during the year.

The high price of tin has created an intensified investigation of U.S. deposits, but the outlook is unpromising, the 1918 tin output being estimated at not more than 200 tons of metal. Alaska is still the main ore-producing centre, where the tin ore is mainly a by-product of alluvial gold mining operations. Developments are taking place in Nevada, where ore has been found, but so far is too thinly distributed to be workable. There has been a little activity in S. Dakota and N. and S. Carolina and there is prospect of some in Texas.

In 1917 three-fourths of the ore exported from Bolivia was sent to England for smelting and the equivalent in metal re-exported to the United States. Previous to the war Germany had treated much of this, and it is claimed that it would be more economical for the ore to be shipped directly to the States and smelted there. The two American smelting firms hope to have an estimated capacity of between 14,000 and 18,000 tons of metal for 1918. Seventy tons of tin were electrically smelted in Bolivia in 1917, and a new Chilian plant is expected to produce thirty tons per day.

The quantity of tin imported as metal has risen from 47,500 short tons in 1914 to 72,100 in 1917, the Straits Settlements, England and Dutch East Indies supplying the bulk. The price of Straits tin steadily rose during the year from 44·19 cents in January to 85·35 cents per pound in December. A comparison between price and world's output, illustrated by two plotted curves, shows that the price of tin had risen at a somewhat faster rate than the world's output. The war, however, has had a considerable effect upon the price and supply. The complete blockade of the Central Empires has added 21,000 short tons of tin to the available supply of the rest of the world.

The world's production in 1913 was estimated at 146,230 short tons of tin, and in 1917 at 137,200 tons: the steady yearly decline of the Federated Malay States being counterbalanced by the increased Bolivian production. This decline is attributed partly to a decrease in labour supply, but it is probably due to the approaching exhaustion of the richer, more easily worked deposits. Expensive installations will be necessary to work the lower-grade deposits profitably. Between 70 and 75 per cent. of these Malayan mines are under Chinese management and the district is second only to Cornwall in the production of lode tin. Fifty per cent. of the world's tin is produced within the British Empire.—(*U.S. Geol. Surv., Sept.*, 1918.)

Saving Coal in Boiler Plants.—A Technical Paper (No. 205) on this subject has been issued by the United States Bureau of Mines in the interest of more efficient utilisation of fuels. The author, H. Kreisinger, is of the opinion that large plants are usually well equipped and operated with efficiency, but that small and medium-sized plants are badly equipped and inefficient. In the average steam plant about "57 per cent. of the heat in the coal burned under the boilers is utilised in making steam and about 43 per cent. is lost." The opinion is expressed that the average efficiency can easily be raised to 67 per cent. and exceptional instances are mentioned where efficiency of 80 per cent. is obtained. The automatic CO_2-recorders are recommended, but manufacturers are cautioned against depending entirely on the figures given by apparatus of this class. Such a recorder does not indicate the incompleteness of combustion, and therefore an Orsat or other suitable apparatus is essential, not only for checking the accuracy of the figures indicating the percentage of carbon dioxide, but to show how much, if any, carbon monoxide is present. An average of 10—12 per cent. of the former in flue gases, the author thinks should be considered good, provided the percentage of monoxide be low. In some up-to-date factories the highest possible percentage of dioxide consistent with the elimination of monoxide is aimed at. The advantage of a rapid and convenient method of regulating the air supply is referred to, and, as a guide to accuracy in setting the damper, draft gauges which can be easily seen by the fireman are recommended. The importance of checking the temperatures of exit gases is emphasised, and reference is made to the necessity of keeping accurate and reliable records of fuel used, water evaporated, etc. The paper deals with an important subject and gives useful information in a concise form.

The Fuel Problem in Brazil.—Before the war it was easier and cheaper to import coal than to attempt the development of native resources. Where coal could not be obtained wood was used, and except in Rio de Janeiro little capital was put into hydro-electric schemes. In 1913, 2,530,000 tons of coal was imported (86 per cent. coming from England), whilst in 1917 only 877,675 tons came into the country (21 per cent. from England and over 78 per cent. from the United States).

The Federal Government has recently been taking steps to encourage the exploitation of native fuel resources, which consist of:—(1) Coal deposits of the 3 southern states, Rio Grande do Sul, Santa Catherina and Parana; (2) some inferior seams of coal in Sao Paulo and lignite in Para and Amazonas; (3) oil from the Bahia region; (4) oil shale from Parahyba; (5) wood, which is abundant everywhere; (6) water power from the cascades and falls of the coastal highlands. The average of the analyses of 21 samples of South Brazilian coal gave:—Moisture, 2·64 per cent.; volatile matter, 22·31 per cent.; fixed carbon, 42·04 per cent.; ash, 32·26 per cent.; sulphur, 6·22 per cent.; phosphorus, 0·023 per cent.; calorific value, 9909 B.T.U.

The two chief mines now working are the Sao Jeronymo and the Jacuhy. The first has two shafts and is producing 650 tons daily, and expects with a third shaft to produce over 1000 tons per day. The Jacuhy mine was expected to turn out about 10,000 tons per month by July, 1918. The latter mine is partly owned by the Government.

Considerable interest is being shown in the development of the Bahia oil wells and of the Parahyba shale. The latter is reported to be richer than Scotch shale, yielding 16½ per cent. of oil (about 35 gallons per ton of shale). The forest area of Brazil, estimated at 1,500,000 sq. miles, yields abundance of timber fuel, which has been used extensively; but only recently has attention been paid to re-afforestation. The eucalyptus tree has been successfully introduced; this tree yields wood at the end of 5 years. During the fuel shortage wood has been largely used on the railways and river steamships, but its use has not been entirely satisfactory, especially on the heavy climbs over the coastwise range from the manganese and iron mines of Minas Geraes. Powdered

waste coal has been used on a number of locomotives specially equipped for burning coal dust.

When normal conditions once more prevail it is anticipated that Brazil will again become dependent almost wholly on imported fuel. The Itabira Iron Co. (English), which is exploiting iron mines in Minas Geraes, proposes to run a fleet of vessels to Europe carrying iron ore and returning with European coal. Water power developments are afoot in the State of Sao Paulo, and already a number of small factories depend on the hydro-electric power from the plant in Sao Paulo City.—(*U.S. Com. Rep., Nov.* 23, 1918.)

Vegetable Oil in Brazil (Para).—A report from the British Consul in Para states that during the war the manufacture of salad oil from the Brazil nut (castanha) was established at Para. In ordinary times the price of these nuts is too high for the manufacture of oil, and it is not yet certain that the new development will be permanent. One cwt. of seed will yield 2¼ galls. of oil, and of the two factories at present engaged on the work one of them has a maximum output of 133 galls. per day. The process is simple and practical. The kernel has first to be taken from the shell, and in order to facilitate this process the nut is subjected to heating by means of steam, or in an oven. Female hand labour is employed in shelling, on completion of which the kernel is placed in a revolving crusher, and the oil is extracted from the resultant paste by hydraulic pressure. The filtered oil has a pure light golden colour, and both in flavour and odour is very palatable and agreeable. The residue is at present used for fuel in the factory, but it has every appearance of being admirably suited for the manufacture of cattle food. The nut-shells are consumed in the factory furnace, and the ashes could no doubt be utilised for the manufacture of alkali.

During the past year the same factory utilised 50 tons of ucuuba nuts in the manufacture of a fat used in candle and soap making. Both shell and kernel are used in the process, and it is stated that the raw material yields only 30 per cent. of fat owing to the existing deficient mechanical installation, but that better results are expected from the application of a chemical process which is at present being studied. The fat now produced is sold for 1·4 milreis (1*s.* 4*d.*) per kilo. The exports of ucuuba nuts during the first six months of 1918 amounted to 485,337 kilos., of which 413,690 kilos. went to Europe and the remainder to the south of Brazil.—(*Bd. of Trade J., Jan.* 9, 1919.)

Crisis in the German Sugar Industry.—The sugar industry is threatened with a serious crisis, leading possibly to a complete collapse, on account of the sudden demobilisation. The chief need is of coal and the means of transporting the beetroot, which is now exposed to the cold and may spoil. The sudden withdrawal of prisoners of war has led to a shortage of labour which has hitherto by no means been made good by the introduction of demobilised workers. In addition, the Workmen's and Soldiers' Councils in some districts have already introduced the 8-hour day, which is economically unworkable in the sugar industry. Pressing representations have been made to the Government and other authorities, which have promised every consideration.—(*Welthandel, Nov.* 29, 1918.)

Alcohol from Swedish White Moss.—The County Syndicate Aktiebolag has petitioned the Swedish Government for permission to make 5,000,000 litres (1,321,000 gallons) of alcoholic spirit from white moss, of which there are enormous quantities available. The quality of such alcohol is said to be very good, and its cost less per litre than spirit made from grain or potatoes. It can be easily denatured. The petition proposes that the alcohol be manufactured under official supervision and that the Government be taken in as a partner.—(*U.S. Com. Rep., Dec.* 21, 1918.)

Protest against Nationalisation of the German Dye Industry.—Considerably more than two thousand technical and commercial officials of the Leverkusen Dye Works (formerly Fr. Bayer and Co.) have sent a telegram to the Imperial Chancellor protesting against any attempt to nationalise the dye and medicaments industry. They point out that dyes and pharmaceutical products are among Germany's chief exports, that the raw materials for their production are entirely of home origin, and that their sale in foreign countries is the means of bringing much money into the fatherland. The industry, which has been built up by unremitting scientific and commercial activity, was only able to attain its commanding position by reason of its freedom from bureaucracy and its disregard of costs, however great. Nationalisation would be the quickest and surest method of completely wrecking this example of German industry.—(*Z. angew. Chem., Dec.* 13, 1918.)

REPORTS.

THE MANCHESTER STEAM USERS' ASSOCIATION.

Memorandum for 1917-18, by C. E. Stromeyer, Chief Engineer.

An investigation into a number of water softening plants showed that the principles of the various types had not been materially changed during the past fifteen years. The Permutit process, which involves no diminution of mineral matter but simply the conversion of salts of calcium and magnesium into the corresponding sodium salts, is expensive by reason of the quantity of common salt required for regeneration. Two tons of salt are required for every ton of lime removed from the water; moreover, the salt must be as pure as possible, the output being nearly doubled by using pure salt instead of rock salt or natural brine. The treated water contains a relatively large quantity of dissolved salts which accumulate in the boiler and necessitate frequent blowing down. The process is sometimes used as a means for removing the residual hardness left by the lime and soda process.

The degree of completion of the softening reactions in the lime and soda process are dependent on three factors: temperature, time and contact. It has been found that by allowing pure calcium carbonate to act on sodium sulphate solution, a reaction takes place which is equivalent to the production of 2·43° of hardness; other similar experiments indicate that the ordinary cold softening processes cannot reduce the hardness below 2·4°. Ample time and agitation must be allowed for the completion of the reactions before any attempt is made to separate the precipitated matter from the softened water. Further, in order to facilitate removal of the precipitated matter by sedimentation and filtration, large particles should be allowed to form. The conditions governing this are:—The slower the chemical process, the higher the temperature at which it should be carried out; and the more violent the agitation of the water under treatment, the larger will be the sediment particles.

The majority of continuous softeners operate on the principle that, in the absence of eddy currents, the downward velocity of the majority of the particles is greater than the upward velocity of the water, those particles which are too small to sink being carried forward with the water and caught

in the filter; this would include all solid matter produced by any softening which had taken place in the settling tank. By causing the treated water containing the suspended matter to flow horizontally in such a manner that eddy currents are eliminated, the particles, being heavier, naturally sink, and a depth of clear water will be produced depending on the length of horizontal flow. In only one softener, and in a somewhat modified form, has this principle been adopted. Insufficient attention appears to have been paid to the time necessary for reaction, and to these settling and filtering problems.

The tendency in some cases of softened water to cause corrosion is attributed to the co-existence of sodium chloride, sodium carbonate, and dissolved air in the water; sodium carbonate acting as a polariser, and sodium chloride, having the reverse effect, will produce patches of polarised and depolarised iron, resulting in electrolytic corrosion of the depolarised areas. Good preventives are the use of a slight excess of sodium carbonate in the softening operation, or the addition of tannin to the feed-water. In no case was corrosion detected where Permutit-treated water was in use.

The possibility of employing hot softeners or even distillers depends on the completeness of the heat exchange, and the costs on the plant required to effect this. The removal of scale and sediment gives trouble.

It is important to keep a close watch on the concentration of salts in the boiler, more particularly, as might be expected, where the feed-water is highly charged with sodium chloride, than where sodium sulphate is the main constituent. Collapses are recorded where in one case the concentration of the former reached 8 per cent. and in another case not until the latter reached about 30 (of the anhydrous salt) per cent.

A unique case of external uniform corrosion is reported connected with the use of coke as a fuel. Anhydrous ferrous sulphate was found near the corroded part, and the cause is attributed to the absorption of sulphur trioxide by the scale during the run, and its subsequent conversion into sulphuric acid by absorption of moisture from the atmosphere when lying idle.

THE PRESERVATION OF LIQUID EGGS WITH BORIC ACID.

Report by Dr. A. W. J. MacFadden on the Work of Inspectors of Foods during the Year 1917-18. (H.M. Stationery Office. Price *3d.*)

In connexion with the importation of liquid eggs from China and with the use of boric acid in preserving them, the Report states that prior to the war such eggs were mostly sent to Germany, and that the few which came to this country were used mainly for industrial purposes such as leather dressing, and to a small extent for confectionery. Since 1914, however, large consignments have been received in the United Kingdom, the egg yolk and egg albumen usually being packed separately. Samples of yolk analysed by the City of London Analyst were found to contain from 1·35 to 2·08 per cent. of boric acid, and in some cases common salt up to 10 per cent. was found, together with a smaller amount of boric acid. The use of these eggs was formerly confined to the manufacture of cakes, biscuits, etc., but latterly large quantities have arrived packed for domestic use in small tins and jars containing the equivalent of 9—12 eggs, or more. In this form the product has been available to the general public for use in puddings, etc., and as the amount of boric acid present has been found excessive, its employment for domestic and restaurant use is open to very serious objection. The Government Chemist has examined a series of samples packed in this manner. The results showed amounts of boric acid varying from 40 to 113·4 grains per lb., together with added water, some of which was probably due to the addition of this acid in aqueous solution. It was also observed that the proportion of yolk to white was very different from that in genuine eggs: and the statements on the labels regarding the egg equivalent of the contents of the packages were often quite misleading.

The public health authorities of the districts concerned have made it a condition of allowing the importation of preserved liquid eggs that a guarantee shall be furnished by the importers (1) that the material will be sold only to firms engaged in the bakery, wholesale confectionery and allied trades, and that when used in products prepared for human consumption the ultimate amount of boric acid contained in such products will be negligible in amount; and (2) that the eggs will not be sold to the general public by retail over the counter, and that with a view to ensuring this they will not be put up in receptacles containing less than 7 lb.

As the importation of egg products from abroad will necessarily increase in the future it would be very advantageous, both from the point of view of the health of the consumer and of the economy in shipping space, if arrangements could be made for the product to be shipped as dried egg instead of in a liquid form. Dried egg imports have proved very successful and if the eggs are prepared and packed properly in this form they are a wholesome and useful foodstuff.

Other subjects discussed or referred to in the Report are:—Army food manufacture, food poisoning, botulism, and dried milk.

THE REPORT OF THE INDIAN INDUSTRIAL COMMISSION.*

During the years just preceding the war a new spirit had arisen in India, which demanded industrial development of the country on Western lines. This spirit, which was strengthened by the new economic conditions brought about by the war, found concrete expression in the resolution moved in the Imperial Legislative Council for a clear declaration of the industrial policy of the Government. Consequently in May 1916 the Government appointed the Indian Industrial Commission with a view to examine and report upon the possibilities of further industrial developments of India. The Commission was presided over by Sir Thomas Holland, Kt., of the Manchester University. After two years of deliberations and examination of evidence, submitted by 472 witnesses, a bulky report has just been published, which gives the conclusions arrived at, the detailed evidence being published separately in six other equally bulky volumes. These reports contain amongst other things much interesting information regarding the future prospects of chemical industries in India.

The Commission recognises that Indian industries are now, and will be in future, based chiefly on the agricultural produce of the country, the chief of which is cotton. Recommendations are made for increasing the production of long-staple cotton in the country by systematic agricultural and botanical research. Sugar is of almost equal interest to Indian consumers and will prove the foundation of a great industry. Proposals are made for improving the indigenous types of sugar cane by cultural methods and for increasing the yield of sugar per acre and per ton of cane. Various fibre crops are noted, *viz.*, hemp (*Crotalaria juncea*),

* This Report has been issued in India; the Home Edition is not yet to hand.

jute, flax, and rhea, some of which, such as flax, are required for manufactures of national necessity. Oil seeds are grown all over the country and are of extreme importance; over £18,500,000 worth of these were exported in 1913-14. The success of large-scale oil mills and the manufacture of soaps, candles, etc., in the country for the utilisation of these oil seeds will mainly depend on tariff policy. In hides and leather the trade before the war was mainly in the hands of the Germans. The principal difficulty at present is lack of organisation and expert skill. Chrome tanning, so far, has made comparatively little headway, but progress of late has been rapid. Vegetable tanning materials like Acacia arabica, Cassia auriculata, divi-divi and myrobalans are obtainable in large quantities but are chiefly exported; suggestions are made for their retention in the country and for the manufacture of tannin extracts. For this industry the question of tariffs also plays an important part, though it will not be possible for some time to come for India to tan all her hides.

The Commissioners then proceeded with the examination of the mineral deposits of India, and came to the conclusion that these are sufficient to maintain most of the "key" industries, except those that require vanadinm, nickel and possibly molybdenum. Indian coal is very unevenly distributed and generally poor in quality. Broadly speaking, there is a general scarcity of good cooking coal for metallurgical purpose. Iron ore is found in many parts of the country but as a rule ore of good quality is not found in proximity to satisfactory coal supplies. Rich deposits of lead and zinc ore exist in Burma and arrangements are being made to smelt the latter in India. The copper ore mines of Singhbhum will soon be developed, and smelting works have been erected and have already started operations. High-grade chromite is produced in large quantities. Bauxite deposits have been found and a large hydro-electric scheme is in progress for the manufacture of aluminium. Manganese ore is extracted in very large quantities for export, but measures have been taken for making considerable quantities of ferro-manganese. The richest sources of tungsten ores have been in Burma, where also are to be found ores of tin and antimony. India occupies the first place as a mica-producing country, and mica of the highest grade is produced in Bihar. Large cement works have been started and equipped with plant of modern designs; there are still great possibilities for cement manufacture in India.

Experiments on various clays for pottery have been recently made, and promise great results. Glass manufacture has now received attention, for suitable sand and lime occur in many parts of the country. India at one time possessed a practical monopoly of saltpetre. Owing to its admixture in natural state with salts its manufacture was considerably restricted, but it has recently expanded under the stimulus of war prices.

Among forest products, lac and caoutchouc are of importance. Owing to want of exploitation incomplete use has been made of forest resources. The extension of research and facilities for transport will add considerably to the economic utilisation of these and many other valuable products.

Very definite recommendations have been made for the manufacture of paper pulp, and excellent paper has been manufactured from bamboos. Development of this industry will prevent the dumping of wood pulp from Scandinavia or North America.

Wood distillation and manufacture therefrom of acetone, alcohol, acetic acid and a number of other important products offer the greatest field for large-scale undertakings. A very large wood distillation plant is being set up by the Mysore Government in connexion with its charcoal-steel production.

Turpentine and rosin are now produced and more work is being done in this direction. No other country offers such good prospects for the establishment of a national essential oil industry. The production of sandal wood oil has made rapid progress, as has also the manufacture of thymol. The Commissioners note with considerable assurance the immense future which awaits the development of fisheries in India.

Indian Chemical Industries.—India imports chemicals to the value of more than £670,000 a year, but owing to the relatively small quantities of the different kinds used, the Indian manufacturers have confined their attention to the manufacture of heavy chemicals. Simple drugs and extracts are also produced to some extent, but the output has been considerably restricted by excise regulations.

India is dependent on outside sources for sulphur. Very few sulphide ores have been found in the country, and until arrangements have been made for the production of sulphuric acid in different parts of India, matches, oils, explosives, disinfectants, drugs, dyes, etc., will have to be imported. Attempts are being made in Bombay and at Sakchi to instal fairly large sulphuric acid plants, but it will be a long time before India will be self-sufficing in this respect. With the exception of sulphur other raw materials for heavy chemical manufacture are found in abundance. Salt occurs plentifully everywhere in India except in Bengal, where it is very urgently needed in large quantities for chemical purposes. Messrs. Tata Sons & Co. have already in hand a very large scheme for the production at Chilka Lake of from five hundred thousand to a million tons of salt per year. This scheme will provide India with extremely cheap salt necessary for the starting of chemical industries, especially caustic soda, for which there is a growing demand for paper pulp and soap manufacture. A very large plant has been set up in Sakchi for the recovery of by-products from coke ovens, which will be able to supply India's whole demand for benzol and related products.

To make good many of the deficiencies, the Commissioners recommend the Government to encourage foreign firms, which have special knowledge of and interests in the country, to open branches of their works in India, especially for the manufacture of heavy chemicals, rubber and vulcanite. The Commissioners propose that for the development of industries on sound lines the Government should create a new Department of Industries, which should be in charge of the various scientific services, of which the Indian Chemical Service is the most important. The headquarters of the chemical branch of the Department will be at Dehra Dun under the charge of a Chief Chemist to the Government. Under him directly would be a staff of several chemists and specialists. The results of the work of these chemists will be published in a new Government chemical journal. The necessary *personnel* for these Chemical Services will be recruited from the Indian universities, so far as junior appointments are concerned, but the senior appointments will be filled at least for some years from English universities. The Chief Chemist will get an annual salary of £2400. There will be eight other senior officers with salaries of £800 per annum; and the yearly expenditure of the Chemical Service is estimated to be over £34,000. The total of capital expenditure involved in the proposed schemes is one million pounds, a sum which includes provision for industrial schools, technological institutes, etc. In addition to this the Government would also aid nascent industries in various other ways, such as, *e.g.*, by land acquisition, concessions in railway rates, and by giving direct financial assistance.

LEGAL INTELLIGENCE.

CLAIM FOR INCREASED IMPORT DUTY ON SACCHARIN. *American Commerce Co., Ltd., v. Frederick Boehm, Ltd.*

In the King's Bench Division on January 22, the American Commerce Co. claimed to recover from F. Boehm, Ltd., the sum of £300 for increased import duty on 100 lb. of saccharin, sold by them under a contract, to be shipped in February-March, 1918, from New York to a British port, at 220*s.* per lb., c.i.f., duty paid. Subsequent to the contract, but before the goods had been delivered, the import duty was raised by 60*s.* per lb., which the plaintiffs paid. They, however, claimed that under the Finance Act of 1901 they could recover the increased duty as there was no agreement to the contrary. Mr. Justice Bray upheld this claim, and gave judgment for the plaintiffs, with costs.

APPLICATION TO RESTORE TO REGISTER AN AVOIDED ENEMY TRADE MARK.

Before the Comptroller of Patents (Mr. H. Temple Franks), on January 30, in the Patents Court, an application was made by Genatosan, Ltd., that an order for the revocation of the trade mark "Sanatogen" should now be rescinded. The application was opposed by Boot's Pure Drug Co., the British Sanatogen Co., Ltd., the Chemists' Supply Association, Casein, Ltd., John Lorimer, the Drug Club, and Southall Bros. and Barclay, Ltd.

Counsel for the applicants said that the "Sanatogen" business, being an enemy property, was seized after the beginning of the war and a Receiver appointed, who sold it to a syndicate of the late Lord Rhondda which took the name of Genatosan, Ltd. Prior to the conveyance there had been a suspension of the registration of the trade mark "Sanatogen" so that the trade mark as a registered trade mark did not exist but it continued to exist as a common law trade mark. Therefore the applicants, as the purchasers, had the exclusive right to the mark, and they submitted it was desirable that the word "Sanatogen" should be restored to the register.

The Comptroller said the application would have to be considered.

GOVERNMENT ORDERS AND NOTICES.

EXPORT PROHIBITIONS.

Further relaxations of existing export prohibitions have been announced by the Board of Trade; they became valid on the dates specified.

Headings transferred from one list to another.

From List A to List C:—

Carbon, coke oven; carbon, gas; carbon, pitch; cotton rags and rags containing cotton; esparto grass; hemp waste; jute waste; linen rags; linen waste; nightlights; oil of cedar wood; oil of peppermint; oil of sassafras; sisal strings, old; sisal waste; tinplate scrap, including scrapped and disused receptacles wholly or partly made of tinplate. Chemicals:—Agowan seeds; areca nuts (betel nuts); benzol and its compounds and preparations; cantharides; dimethylaniline; hydroquinone and mixtures containing; jalap; meta-cresol; methylaniline; para-cresol; paraffin, liquid medicinal; squills.—(Jan. 23.)

Arrowroot; banana meal and banana flour and preparations containing; barometers and their component parts; caramel, liquid or solid; cassava powder; celluloid; "celluloid" sheet, non-inflammable, and similar transparent material, non-soluble in lubricating oil, petrol, or water; cornflour; corn grits; dextrin and all articles and mixtures and preparations containing; farina; hominy; milk sugar (lactose); potato flour; sago and sago flour and meal; soap, including soft soap; soups, compressed and desiccated; spelter and spelter dross; starch, articles containing starch and mixtures and preparations of starch; stellite and similar alloys; tapioca and tapioca flour; zinc, alloys of zinc, manufactures of zinc and zinc dust; zinc ashes. Chemicals:—Saccharin, and articles, mixtures and preparations containing; zinc sulphide.—(Jan. 30.)

From List B to List C:—

Cadmium, alloys of cadmium and cadmium ore; carborundum, alundum, crystolon, and all other artificial abrasives and manufactures thereof; cylinders, metal, capable of use for the storage of gases or liquids under pressure; ferro-cerium; fustic (chips and extracts); oil, sandalwood; salt (other than rock salt, which is already on List C); sandalwood for medicinal purposes; silicon spiegel. —(Jan. 23.)

Cloves; coir yarn; ginger; mandioca; palladium and its alloys and manufactures containing; vanadium; vanadium ore; vanillin; wolfenite; zinc ore.—(Jan. 30.)

Altered Headings.

(A) Bromine; (A) hydrobromic acid; (C) bromides not otherwise specifically prohibited; (A) fibres, vegetable, not otherwise specifically prohibited, except China grass (ramie fibre); (C) China grass (ramie fibre); (A) lead, dry white; (C) lead in all forms not otherwise prohibited; (A) manures, compound, containing either sulphate of ammonia, superphosphate of lime, or potash; (C) manures, compound, not otherwise prohibited; (B) molybdenum filament; (C) molybdenum and molybdenite, except molybdenum filament; (A) quebracho extract, and extracts containing quebracho; (A) liquid chestnut extract; (C) tanning materials not otherwise prohibited; (A) wood and timber of all kinds, hewn, sawn, or split, planed, or dressed, except lignum vitæ, mahogany and hardwoods; (C) mahogany and hardwoods; (A) woollen rags, shoddy and mungo applicable to use otherwise than as manure or as roofing felt rags.—(Jan. 23.)

(A) Cereals, prepared foods derived wholly or partly from, containing milk; (C) cereals, prepared foods, derived wholly or partly from, except such as contain milk; (A) glucose; (C) articles, mixtures and preparations containing glucose not otherwise prohibited; (A) tinplates; (C) gas meters and component parts thereof made wholly or partly of tinplate; (A) wire rods; (B) wire of iron or steel.—(Jan. 30.)

Validity of Export Licences.—1. The Director of the War Trade Department announces that Privy Council Licences are now as a general rule issued without a time limit, except in the following cases:—(*a*) All licences for export to: Norway, Sweden, Denmark, Holland, Switzerland, Iceland, Faroe Islands, Greece; (*b*) all licences for the following goods, irrespective of destination: raw cotton, kapok, coal, coke and manufactured fuel.

2. The right is still reserved to insert a time limit in any licence issued after the date of this notice should circumstances demand.

3. Subject to the foregoing exceptions, all licences valid for shipment on or after July 1, 1918, may, unless specially revoked, be regarded as still valid irrespective of the date of issue or of any time limit they contain.

Scottish Paraffin Wax.—With reference to the notification concerning the export of Scottish paraffin wax (this J., 1919, 35 R), the War Trade Department now states that applications for export to approved destinations will be considered irrespective of the melting point of the wax.

Sulphate of Copper and Coal Tar Pitch.—The Director of the War Trade Department announces that an open general licence has been issued permitting the export of (1) sulphate of copper and (2) coal tar pitch to all destinations except destinations in European and Asiatic Russia and in other foreign countries in Europe or on the Mediterranean Sea other than Italy and Italian Possessions, Belgium, Portugal, Spain, Greece, Morocco, other than French Morocco, Palestine and Syria, as far north as a line from Alexandretta to Aleppo inclusive, and as far east as the Hejaz railway inclusive. Applications for licences to export the above-mentioned goods will therefore in future only be required when it is desired to export them to France, French Possessions, or any of the neutral destinations to which goods on List C are prohibited.

Blended Oils, Resins, etc.—The Director of the War Trade Department announces that an open general licence has been issued permitting the exportation of the following goods to all destinations except those specified in the preceding note :—Blended oils containing not less than 50 per cent. mineral oil, and of "Phosto" animal food, kava kava resin, scammony resin, varnishes of all kinds, floor and other polishes, paint other than gold paint.

IMPORT PROHIBITIONS.

The following temporary General Licences which have been issued since the armistice, and which were announced as being terminable on March 1, will be withdrawn with effect from that date :—

Aluminium, manufactures of; aluminium powder; cement; diatomite or infusorial earth; electrotypes; fatty acids; fire extinguishers; methyl alcohol; oil cloth; perfumery and toilet preparations; photographic apparatus; salt; slide rules for engineers and draughtsmen; soap; straw envelopes for bottles; weighing machines, scales and balances of all descriptions.

The following General Licences will be continued till July 1 :—

Aerated mineral and table waters (unsweetened); cocoa (raw); gum copal; gum kauri; horns and hoofs; ivory (vegetable); nuts; sugar cane; goat and sheep skins, tanned; sheep and lamb skins, dressed.

The following additional General Licences are being issued and will also be valid till July 1 :—

Cassia lignea; hides, wet and dry; marble; pimento.

PETROLEUM PRODUCTS (WHOLESALE PRICES) ORDER, 1919.

This Order, which was made by the Board of Trade on January 31, revokes previous similar Orders, and came into effect on February 1. The schedule gives the maximum prices of the different products, as follows :—

Spirit in cans, per gallon: Aviation, 3*s.* 0½*d.*; special boiling points, 2*s.* 11½*d.*; No. 1, 2*s.* 10½*d.*; No. 2, 2*s.* 9½*d.*; No. 3, 2*s.* 8½*d.*

For delivery to commercial consumers (not for re-sale) in steel barrels, 1*d.* per gallon less than can price, and for delivery in bulk to commercial consumers (not for re-sale), 1½*d.* per gallon less than can price.

1*d.* per gallon may be added to all above prices when sold for delivery in Scotland or Ireland.

Kerosene, per gallon: Long time burning oil in bulk, 1*s.* 3*d.*; No. 1, 1*s.* 3*d.*; No. 2, 1*s.* 2*d.*

For delivery in barrels ex wharf, 2¼*d.* per gallon additional.

1*d.* per gallon may be added to all above prices when sold for delivery in Scotland or Ireland.

Raw white spirit as imported, ungraded and unrefined, sold to manufacturers for distribution in accordance with licences issued by the Ministry of Munitions, 2*s.* 3*d.* per gallon.

Gas oil in bulk ex wharf, 8½*d.* per gallon. For delivery in barrels ex wharf, 3¾*d.* per gallon additional.

Fuel oil in bulk ex wharf, £7 10*s.* per ton. For delivery in barrels ex wharf, 3¾*d.* per gallon additional.

OTHER ORDERS.

The Radio-active Substances Control (Suspension) Order, 1919. Ministry of Munitions, January 21.

The Whale Oil (Suspension) Order, 1919. Ministry of Munitions, January 31.

The Imported Flax (Dealings) No. 2 Order, 1919. Army Council, January 30.

Orders Cancelled by Notice.—The Raw Asbestos Order, of January 5, 1918. Admiralty, January 16. The Imported Hides (Control) Notice, 1916, and the Imported Hides (Dealings) Order, 1916. Army Council, January 23. The Bung Gut and Goldbeater Skins Order, 1917. Admiralty, January 23.

Permitted Explosives.—By an Order of the Home Secretary, under the Coal Mines Act of 1911, the use of the explosives Samsonite No. 2 and Samsonite No. 3 is now permitted.

Linseed, Rape and Castor Oils.—The Ministry of Food announces that supplies of these oils are sufficient to permit distribution to any consumers in quantities not exceeding 5 tons in 1-ton lots during any one calendar month.

Sulphate of Copper.—The Food Production Department announces that the Government does not propose to control the selling price of copper sulphate this year.

TRADE NOTES.

BRITISH.

General Trade Outlook.—Speaking at Huddersfield on January 23, Sir Albert Stanley, President of the Board of Trade, said he must confess to some measure of disappointment concerning his earlier hopes of a speedy solution of the problem of the dye industry, but he believed that this vital industry had now finally been established upon a firm and lasting foundation. Speaking generally, the trade of the country was not advancing as might reasonably have been expected. It was no exaggeration to say that the war had left an empty world which was only waiting to be refilled, and it was incumbent upon them to look for reasons why the demand, which certainly existed, had not been met with greater enterprise. It was the deliberate policy of the Government to abolish the restrictions upon trade as rapidly as possible; but it could not be done in a day. Many restrictions upon exports had been removed, but those which referred to enemy countries, and countries bordering thereon, could not be relaxed until the peace had been secured. It was also proposed to bring the system of priorities to a speedy end, and to terminate those now in existence in the early part of March. As regards the shipping question, there was more tonnage available than there were cargoes to carry, and by the coming summer the world's available shipping would be at least as great as existed before the war. There was no fear of a shortage of raw materials. The Government had

been urged by various interests to retain its control over imports until the manufacturers were able to re-establish themselves on a peace footing; this was a fair proposition and one which the Government should accept. One of the first matters to be dealt with in the new Parliament would be to stop "dumping," and he could not understand why it had been allowed in the past. The equipment of a new Ministry of Commerce, he believed, was about to be realised; its function would be to advise, and not to control or interfere with trade interests. Nothing could be more disturbing to the development of our trade and industries than constant labour unrest, and some way must be found of settling disputes without resort to strikes.—(*Bd. of Trade J., Jan.* 30, 1919.)

Opportunities for British Chemical Manufacturers in Holland.—There are a number of laboratories in Holland, writes Dr. F. M. Jaeger, professor of chemistry at Groningen University, to the British Science Guild, which will certainly purchase chemicals and scientific preparations from England and France, instead of from Germany as hitherto, if they can be supplied in adequately large quantities, in sufficient variety, and at competitive prices. What is needed at the moment is a large number of priced-catalogues so that orders may be given before the Germans re-enter the market. A radical alteration is required in the manner of advertising. The Germans send price-lists and prospectuses with full details, together with views of their country and full information for travellers. Up to now both the English and the French have failed in this respect.

FOREIGN.

The Post-War Trade of Sweden.—H.M. Consul-General in Sweden has transmitted a statement concerning the prospects of various trades and industries after the war.

Lubricating oils and greases, and fats for the manufacture of soap, are now being made from meat and fish offal. It is anticipated that this manufacture will continue, and it will, doubtless, affect the import of oils, but only to a very limited extent, as the demand will always be greatly in excess of local supplies. There will be a great demand for all kinds of oils directly supplies become available, as stocks are completely exhausted. This applies also to manufactured articles, such as margarine and soap. Sweden was, before the war, an increasingly large consumer of margarine, which was imported or manufactured within Sweden to release butter for export

The Government has concluded contracts with a shale crushing company, thus granting the equivalent to a bounty. The shale oil industry will be permanent.

Rosin, which is now being extracted from the refuse from sawmills and other wood, is very largely employed in Swedish industries. The production will probably be continued after the war, and may even be extended, but it will not be able to supply the demand, which must continue to be met by importations.

Paper yarn, or spun paper, has been employed during the war as a substitute for wool, cotton, hemp and jute, and has been used for all textile purposes, for floor coverings and machine belting. It has been used with some success in the manufacture of sacks and wrappings, but cannot compare with jute, being very susceptible to damp. Possibly spinning of paper may develop, but in its present stage it is quite unable to compete successfully with cotton, wool, etc.

Cattle foods are being prepared from cellulose, heather, fish offal, and meat offal, etc. Seed crushing mills have been erected for the treatment of imported seeds, when such again become available. The experiments with substitute cattle foods have not been successful, though all continue to be used for want of the genuine articles. Foods made from meat and fish offal are found to be of more value than the other substitutes, and will continue to be made after the war. Considerable capital has been invested in factories for the treatment of these offals, and the promoters are evidently persuaded that these foods have a permanent value, and will be in demand after the war. Though the output of the Swedish seed-crushing mills, together with the substitutes above referred to, will meet some proportion of the demand, there will still be a considerable demand for imported cake, etc.

Ship's paint, hitherto almost exclusively imported, is being manufactured in Sweden. The demand is at present greatly in excess of the supply, but, given the necessary materials, the production will expand, and there seems little reason to suppose that independence of foreign supplies may not eventually be achieved.

The production of electrolytic copper has been directly assisted by Government subsidy. Before the war this material was not produced in Sweden. This industry will certainly be permanent.

There are no stocks of imported manufactured goods in Sweden. The small supplies which from time to time become available are at once absorbed. The building trade is probably the only one which has been stopped on account of the high cost of materials. There is little or no accumulation of manufactured goods awaiting export, with the possible exception of glass. Such small stocks as may exist will certainly be absorbed without any great fall in prices.

After-war Competition.—The bulk of the chemicals has been obtained from Germany, the most important being carbonate of soda, caustic soda, potash, bicarbonate of potash, chloride of lime, sal volatile, chalk, borax, Glauber's salt, waterglass, and dyes. Large applications have been placed in the United States for the following chemicals:—Boric acid, bichromate of potash, ceresin, chrome alum, coconut oil, palm oil, varnish, raw asbestos fibre and rosin. Sweden is a large producer of window and bottle glass, but imports medical and laboratory and optical glass from Germany. China and earthenware are largely imported from Germany. Large orders have been placed in the United States for sanitary ware.

Electrical factories are dependent on a large import of copper for cables, as the copper found in the Falu Mine and Atvidaberg does not supply a small proportion of Sweden's requirements for electrical fittings.

Iron and steel are main productions of this country, and consequently the export is greater than the import. Steel rods, beams, and profile iron are imported from the United Kingdom, but rails, pipes, and a certain amount of pig-iron are imported from Germany.—(*Bd. of Trade J., Jan.* 30, 1919.)

Panama in 1917.—Business in Panama during 1917 was dull and unsettled and much below the pre-war standard. The total imports were valued at £1,900,000 and the exports at £1,170,000. These were distributed as follows:—Imports: U.S.A. 77%; England 4·4%; China 2%. Exports: U.S.A. 98·5%. The ports handling the export trade were Colon (10%), Panama (4%) and Bocas del Toro (86%). The imports included chemicals valued at £45,000; paints £11,400; soaps £45,000; cotton textiles £78,000, and the following oils:—Cottonseed, £13,500; fuel £16,000; linseed £2080; lubricating £4000; medicinal £2900, and olive oil £2700.

Colon.—The planting of abandoned banana land with coconuts and cacao is proceeding at a rapid rate as is also the cultivation of vegetable ivory (tagua nuts). The Mandenga manganese mine has

shipped nearly 18,000 tons of ore to the U.S.A. since 1916 and 4000 tons await shipment. Other deposits are being investigated. Boring for oil is being started, the indications being promising. A new gas system was installed during the year by an American company and there are factories for making ice and coconut and palm oils. A small works for making laundry soap was obliged to close down for lack of caustic soda. There was a large increase in the number of coconuts exported (19,528,845 as compared with 10,798,705 in 1915), but this was largely made up of re-exports from the Colombian island of St. Andrew.—(*U.S. Com. Rep., Nov.* 5, 1918.)

Quinine in Brazil.—Further regulations, relative to the combating of malaria, have been promulgated in Brazil which affect the preparation and distribution of quinine. Cinchona bark, in addition to quinine salts, will be imported and extraction plant will be installed in the Oswaldo Cruz Institute. Regulations are laid down for the sealing, stamping and marking of the tubes in which the drug is to be sold, and the retailer's profit is limited to 10 per cent.—(*U.S. Com. Rep., Dec.* 11, 1919.)

OFFICIAL TRADE INTELLIGENCE.

(*From the Board of Trade Journal for January* 23 *and* 30.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 73 Basinghall Street, London, E.C. 2, from firms, agents or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

Locality of Firm or Agent	Materials	Reference Numbers
Sydney, N.S.W....	Soap, essential oils, pharmaceutical products	58
,, ,, ...	Aluminium, enamel ware, glass, crockery	*
Wellington, New Zealand ...	Copper-plate, wire and tubing, zinc sheeting, etc.	124
Cape Town ...	Drugs and chemicals ...	127
Toronto	(i) Drugs and chemicals ...	83, 84, 85
,, ...	(ii) Fine chemicals ...	86
,, ...	(iii) Dyes	91
,, ...	(iv) Glass, pottery, enamel ware	95
,, ...	(v) Leather, glass, colours, dyes, essential oils, etc.	89
,, ...	(vi) Paint and varnish ...	96
,, ...	(vii) Nitrate of soda ...	105
Vancouver ...	Chemicals, pottery, stained glass	110
Paris	Tin, tinplate	162
Genoa	Chemicals and drugs ...	137
Spain, Portugal and S. America	Chemicals, drugs, perfumery	170
Lisbon	Chemicals and drugs ...	142
Barcelona ...	Chemicals, drugs, oils, artificial manures	145
Amsterdam ...	Lamp glasses	167
Panama	(i) Soap, washing soda (salsoda), caustic soda, silicate of soda	78
,,	(ii) Soap	79
Sao Paulo (Brazil)	Chemicals, oils, greases ...	130
Rio de Janeiro ...	Chemicals and drugs ...	131
Guadalajara (Mexico)	Gauge glasses	165

A Canadian firm able to supply electrolytic zinc and lead wishes to get into touch with importers in the U.K. Inquiries should be addressed to the Canadian Government Trade Commissioner, 73 Basinghall Street, E.C. 2.

* Apply to the Agent-General, N.S.W., Cockspur St., S.W. 1.

TARIFF. CUSTOMS. EXCISE.

Australia.—A recent Customs by-law, No. 384, specifies the methods to be adopted in denaturing amyl alcohol and fusel oil in order that they may be imported duty-free into the Commonwealth.

Belgium.—Among the articles for which import licences are not required are edible oils and fats, soap, raw rubber, cork, bones, horns, clay, gravel, sand, cement, lime, plaster, bricks, porcelain, pottery, glass, scientific instruments, matches, starch, varnish, oil or spirit, blacking, polish and pharmaceutical products.

Canada.—Shipments of goods destined for Canada will be allowed to pass the Customs at Portland, Maine, U.S.A., under "P.B.F. No. 12" without production of proof of Canadian Import Licence.

From January 1, oleomargarine will only be admitted upon the presentation of a new licence from the Department of Agriculture.

The import and export of all goods, except certain foodstuffs, are now covered by general import and export licences.

Ceylon.—The export duty on rubber has been reduced to Rs. 3 per 100 lb., as from November 19, 1918.

France.—A general derogation of export prohibition has been accorded with respect to the following goods:—

(1) For consignments to Allied or neutral countries, except Switzerland: Carbon brushes for dynamos, silk, spirits and liqueurs, aluminium ware, rubber (with some exceptions), celluloid, photographic plates and papers, saffron and artificial silk.

(2) For consignments to all Allied and neutral countries: Many kinds of paper and cardboard.

France and Algeria.—The revised list of articles the export of which is temporarily prohibited, except under licence, as from January 21, includes hides, hair, grease from hides, bones, hoofs, fats and oils, sugar, gums, alcohol, turpentine, cinchona bark, cellulose pulp, paper, corundum, natural phosphates, lime, cement, petroleum, coal-tar derivatives, certain metals and chemicals, soap, glass, and rubber.

The revised list of goods for which no import licences are required after January 21 includes hair, feathers, hoofs, horns, bones, hides, skins, leather, ivory, fats, oils, waxes, certain foodstuffs, organic manures, vegetable tar, resin oil, certain gums and fibres, tanning materials, certain metals and ores, many chemicals, colours and dyes, perfumes, dextrins, starch, glue, camphor, rubber, mica, felt, etc.

Kedah: Perlis.—The export duty on cultivated rubber was temporarily remitted as from October last.

Netherlands.—The export of bricks, tiles, lime, sandstone, firebricks, etc., is prohibited as from January 17.

New Zealand.—Recent Customs decisions affect the import duty on felted paper and lactogen.

Sierra Leone.—The export of cocoa to the U.K. is now permitted.

Spain.—The export of olive oil is now authorised up to a total quantity of 90,000 tons, subject to permit and certain other conditions. The export tax is reduced to 25 pesetas per 100 kilo. for oil in barrel and skins, and to 20 pesetas per 100 kilo. for Spanish trade-mark brands in tins and bottles.

United States.—Alcoholic liquors may not be imported as from November 21, 1918, except those shipments which were *en route* at that date.

Recent rulings of the War Trade Board affect liquorice root, vanilla beans, furs, skins, tallow, copper ore, copra, rubber goods, shellac and other lacs, cocoa, leather, etc.

REVIEWS.

THE NATURAL ORGANIC COLOURING MATTERS. *By* A. G. PERKIN *and* A. E. EVEREST. *Monographs on Industrial Chemistry, edited by* SIR ED. THORPE. *Pp. xxii + 655. (London: Longmans, Green and Co.,* 1918.) *Price* 28*s. net.*

During the past fifty years the main trend of organic chemistry has been in the direction of the synthetical preparation of substances likely to be of use in medicine or industry, and the great success which has attended this has led to neglect of the study of naturally occurring substances and the processes by which they are formed.

The living organism, by means of reactions occurring at the ordinary temperature, "manufactures" important substances, such as carbohydrates, dyes, alkaloids and proteins, some of which have, indeed, been synthesised in the laboratory but only by the aid of drastic agents incompatible with the life of an organism. Although the statement that many of these naturally occurring substances are not surpassed by any of our laboratory products is more applicable to carbohydrates and proteins than to dyes, Nature has even in the latter case introduced to us two valuable dyes —alizarin and indigo—the study of which greatly facilitated the progress of certain portions of the dye industry. We may, perhaps, even say that it is not improbable that the study of those natural dyes the constitutions of which are at present unknown may throw new light on the relations between constitution and colour and therefore contribute to the progress of the whole dye industry.

Much research still remains to be carried out in this field which has a peculiar fascination for anyone who likes variety and difficulty in the problems he investigates. To such a chemist we have no hesitation in recommending this book as one thoroughly deserving his study. He will find in its nineteen chapters clear and interesting descriptions of work on substances of the most diverse character, such as alizarin, carminic acid, brazilin, berberin, catechin, curcumin, ellagic acid, indigo, lapachol, the flavones, the xanthones, the tannins and the anthocyanins. He will be indebted to the authors for placing at his disposal a book which covers practically the whole scientific literature of the group and which, moreover, in some places contains the results of investigations which are now published for the first time.

Notwithstanding the wide range of the book it is, with the exception of some obvious typographical mistakes, singularly free from errors. The only omission from it of any importance is that of the investigations by Liebermann and his pupils of the dye azafrin, which is closely related to bixin. Also, in a *monograph on industrial chemistry* we should in this case have expected a chapter dealing in a general manner with the manufacture of extracts of dyes, describing for instance the "cutting" and "curing" of dye-woods and some modern types of extraction-batteries. In not including such a chapter in their book the authors have, perhaps, adhered too rigidly to the instructions of the general editor, which exclude "technical *minutiæ* of manufacture" from the scope of these monographs.

It is satisfactory to find the tannins very fully described, all the more since several plants, which are still used as "dyes" in some remote districts, owe their tinctorial properties to the tannins. In addition to the better known poly-depsides described in the chapter on the lichens, the authors might well have given a brief description of the work, however imperfect it may be, which has been carried out on some of the less well-known lichen constituents such as divaricatic and usnic acids. The attention of the younger chemists might thus be drawn to the desirability of investigating the many compounds (about one hundred and sixty) of unknown constitution isolated by Hesse, Zopf and others from lichens, which possibly fulfil important physiological functions in the Cryptogams as the flavones and the anthocyans do in the Phanerogams.

HUGH RYAN.

MODERN COKING PRACTICE. *By* J. E. CHRISTOPHER. *Including the Analysis of Materials and Products, by* T. H. BYROM. *Second edition, in two volumes. (London: Crosby Lockwood and Son,* 1917.) *Price per volume* 7*s.* 6*d. net.*

The second edition of Messrs. Christopher and Byrom's work on Modern Coking Practice retains the advantage of conciseness—the first volume now comprising 104 and the second 120 pages of text and illustrations, to which must be added some 25 plates, mostly reproductions of views of plant. Speaking broadly it presents a very serviceable *epitome* of the principles and practice of the coking of coal for metallurgical uses, with references to sources of more exhaustive information on particular items.

The first volume embodies descriptions of various types of coal washing plant, varieties of coke ovens and of the mechanical appliances used in connexion therewith. The descriptions are good, but only rarely do the authors offer critical observations to guide the reader on the merits of the different types of apparatus or plant. Neither does the book give him sufficiently full data or information to enable him to form for himself a just opinion therefrom on the comparative utility of the various types. Perhaps, when a third edition is called for, the authors will give the reader the advantage of their considered opinion and experience on these points. The methods given for the proximate analysis of coal are in many instances—*e.g.*, the estimation of ash and volatile matter—insufficiently definite to give concordant results in the hands of different analysts. This is especially true of the determination of volatile matter, which, being an empirical test at best, must be carried out in precisely defined conditions.

The second volume deals with ~~the By~~-Products of Coking, including the principles and methods of their recovery and the tests of quality usually applied to them. In the chapters on condensers and exhausters the authors follow their practice in the first volume of refraining from comparative criticism of the different forms of plant described, but in an excellent chapter on "Direct" processes of ammonia recovery there is this useful opinion as to the relative merits of direct and semi-direct processes, *viz.*: "definite advantages peculiar to one system are counterbalanced by equally definite disadvantages, and so far the writer, from observations at several plants of both types, is unable to express any preference for either type." If only the authors could have seen their way to express the results of their experience equally explicitly in other chapters, they would have added immensely to the value of their book. The analytical methods given in the second volume vary greatly in merit, and necessary precautions are often omitted. For instance, in the determination of "free carbon" in tar, the use of a Soxhlet apparatus is rightly recommended, but there is no direction to dry the empty thimble before weighing, though the thimble and contents are dried before the final weighing. Parenthetically the reviewer may observe that in this determination he invariably uses a similarly-treated empty thimble as a counterpoise, and finds the results obtained are much more nearly concordant than when no such counterpoise is used. The book as a whole is, however, free from any serious faults and errors, and is likely to prove useful.

W. J. A. BUTTERFIELD.

INDUSTRIAL UNREST.

What is the meaning of the flood of insurgent labour that has been gathering momentum since the cessation of hostilities?

It is not by examination of the petty details that we shall find a solution, for the unrest is deep-seated. It is not confined to these islands, nor indeed to the working-class. It is the universal aftermath of 4½ years of slaughter, of strain and affliction, borne by the peoples of the warring countries. We are suffering from social high temperature, and we are all badly in need of a febrifuge.

Labour in this mood and environment turns naturally to its many grievances, real and fancied. Those grievances existed before the war, which but served as a searchlight to reveal them in their nakedness. Many promises were made to labour during the war, and it was universal doctrine that labour, which had borne so great a share of the human sacrifice, must receive its square deal when hostilities ceased. And now labour looks, impatient and suspicious, for its promised charter, and sometimes a long way beyond it.

That many present-day labour demands are unreasonable and impossible is not in the least surprising, when we consider how many of the preconceived ideas of political economy have been falsified by events. At a time when we were piling up debt at the daily rate of £1 per head per adult worker, we were advancing wages every three months, we were employing more people than ever before, and the demand for commodities exceeded all experience. Yet within a month or two of every increase in wages the cost of living was found to have risen *pari passu*. Is it strange that the worker, plunged into this economic topsy-turvydom, is under the impression that he can ask for an ever bigger share, and that it depends only on the will or subjection of the controlling capitalist whether he gets it or not?

Turn to the *conditions* of labour. One of the chronic conditions is unemployment. The reserve of labour which in the early days of the industrial system might have been shouldered by the employer was thrust on the workers. Nearly all the rules and restrictions of the trade unions originate from the fact that in the past they have had to bear almost the whole burden of the reserve of labour. Starting with the assumption that there has never been enough work for everybody, regulations have been introduced to spread it over as many people as possible. This is the historic origin of restriction of output, and equally of trade union demands for reduction of working hours in the past. It is the reason for the present demands for the short week—a manœuvre that seems the only possible one to labour, which sees a million people already unemployed, and anticipates that demobilisation, involving displacement on a large scale, will probably double this total.

Whether it be just or unjust to rail at labour for its short-time policy, there can be no question that we should be much better employed in setting up, once and for all, national machinery for dealing with the problem of the aforementioned reserve of labour. The assumption by the State of this burden would be a logical and rational alternative to the restoration of trade union conditions to which we are so definitely pledged.

Much attention has been paid during the war to this and cognate problems of industrial government. The scheme of Joint Industrial Councils, proposed in the well known Whitley reports, was generally accepted as a sound and practical plan for the mutual control of industry by employers, acting through their associations, and by employed, through their trade unions In the *interim*, unfortunately, labour has grown somewhat shy of these Councils, in some cases because they are too constitutional for the hotheads, who refuse to have anything to do with them, in others because the interminable delay in their creation and operation has led to impatience and distrust. And on the whole employers may be said to have cooled off also. Yet the Joint Councils, in principle, should be capable of saving us from anarchy in industry. Their establishment in all industries, and active operation where already established, seems essential for the just settlement which labour has been promised time and again. But if they are to be successful the Councils must be invested with authority; they must have the fullest publicity; and they must receive from the Government something more than faint praise. Above all they must *act*: if they are to be mere talking shops and hobby horses for doctrinaires on both sides, it were better they should not exist at all.

The Industrial Councils should forthwith put into operation constructive schemes for dealing with the reserve of labour, that is with unemployment; they should determine agreed minimum rates of wages (having before them facts and figures of the industry), agreed maximum hours of labour, agreed arrangements for holidays and all extra payments; agreed minimums of safety and convenience in every industry. They should not wait for agitation, but set out immediately with the deliberate object of creating a complete charter for the industry. Associated with the Councils would be impartial Courts of Conciliation and Arbitration for dealing with all cases of dispute within each industry.

With such machinery in existence, strikes and lock-outs could and should be declared illegal by Act of Parliament. To begin with, a logical result of the establishment of Joint Councils would be the legal recognition of trade unions as the only authentic voice of the workers. There would probably ensue a reconstruction of the trade unions by industries rather than by crafts, and a great federating movement—for the unwieldy and overlapping organisation of the unions, to say nothing of anarchy within them, is itself in no small measure the cause of many of our present troubles. Under such circumstances the old justification of strikes would pass away, because the solidarity of labour and employers in each industry would be assured.

At earlier stages in industry strikes and lock-outs were only incidents; in the complex world of to-day they are anti-social developments, and as such cannot be tolerated in a democratic State. But until the "industrial parliaments" come into operation, strikes unfortunately seem to impatient and extreme men their only resource, just as social rebellions were to the pioneers of political democracy. Legislative bodies like the Industrial Councils can at best deal with minimums, and it is useless to deny that labour seeks a higher *status* quite as much as a higher wage. Labour has experienced successive wage advances during the war, which have forthwith been passed on as part of the cost of production—often enough with enhanced profits to the employer. Labour wants a *real* advance in wages in relation to the cost of living. Further, labour suspects that in the ultimate division of the proceeds of industry, wages do not get a fair share with profits; it therefore seeks a more intimate share in the proceeds as well as in the government of industry.

A fair proportion of workers see no hope of attaining these aims save by collectivism—State ownership and control of the means of production—

or by guild socialism—a trustee control by the trade unions. And realising, as every industrialist must, that progress and development, research and invention, in the world as we know it, are mainly the fruit of individualist effort and enterprise, all engaged in chemical industry, who desire to see that industry develop and excel in the British Empire, and who equally desire to give labour the square deal and to bring to an end this strife of destruction, would do well to consider seriously at this time the claim of copartnership to provide that closer sharing of the National Dividend, while at the same time retaining our present system of individual enterprise.

Copartnership is at present practised by a comparatively small number of firms, and what it most needs to-day is an accession of strength; given this, most of its defects would disappear immediately. Copartnership by Act of Parliament is unthinkable, but it does not seem beyond the range of practical politics to encourage its adoption by means of some concession to firms working on copartnership plans. The Italian Government has recently applied this idea in the collection of excess profits.

It is a mistake to suppose that the unrest of labour is purely material. There is a general—often enough incoherent—desire for opportunities for a higher and fuller life. Improvements in education (it is truly a timorous State that provides one half its population with that little learning which is more dangerous than ignorance) as well as in housing are of equal importance with any economic improvements which may be made. It is to-day within the power of each industry to create a solid basis for industrial peace in its own domain by a prompt, whole-hearted co-operation with labour, for which the Joint Industrial Councils seem to provide suitable and adequate machinery.

Reverting to the common assumption of labour that there has never been enough work for everybody, it really remains to be demonstrated that there is not ample work available in the country to give full-time employment to every fit and willing potential worker, provided there is organisation to place him in his proper niche and to furnish a sufficiency of cheap raw materials and implements. There is no question that work breeds work, and restriction of output, whether effected by reduced hours of labour without correspondingly intensified effort, or by reduced effort with unaltered hours of labour, in the long run breeds unemployment. A vital question of the moment, if national industrial suicide is to be averted, is the provision of cheap power and transport. Given these, unemployment need not be feared, for the whole world is an open and practically unlimited market for the proceeds of labour and industry backed by cheap power and transport. In this country at least the cheapness of power and transport must depend mainly on economy in the raising and distribution of coal, and in the utilisation of that coal. If the miner and the mine-owner will do their part in providing cheap coal, the chemist and engineer must and will do theirs in circumventing waste, and the whole world of labour will have no cause to anticipate any appreciable degree of unemployment.

Whitley Councils and Government Employees.—At a conference of Government officials and representatives of trade unions having members engaged in Government industrial establishments, held on February 20, it was resolved to form Whitley Councils for Government Departments, and to appoint a provisional committee to set up machinery to put the scheme into operation. In the event of the Treasury or an employing Government Department exercising a veto over a recommendation of a Joint Industrial Council, the question is to be referred to arbitration.

DETERIORATION IN THE HEATING VALUE OF COAL DURING STORAGE.

G. CECIL JONES.

In Bulletin 136 of the United States Bureau of Mines H. C. Porter and F. K. Ovitz present a full account of the elaborate series of tests begun in 1909 by the United States Geological Survey and continued for five years by the Bureau of Mines with the co-operation of the United States Navy Department (this J., 1918, 615 A). Experiments were made with several varieties of coal, but the most elaborate series was concerned with New River coal, a West Virginian variety largely used by the United States Navy. It is shown that storage under water, whether salt or fresh, effectively prevents deterioration of this coal, but the authors express the opinion that the expense of such storage is not justified, except as a preventive of fires by spontaneous combustion. This opinion is based on the supposition that the experiments described in the Bulletin establish the fact that the New River coal and all the other coals tested, except a black lignite from Wyoming, suffer very little deterioration during ordinary storage in air. "Except for the sub-bituminous Wyoming coal, no loss was observed in outdoor weathering greater than 1·2 per cent. in the first year or 2·1 per cent. in two years."

The writer ventures to doubt whether the data given in the Bulletin do justify this conclusion and proposes to show that these very same data suggest that the authors have overlooked a form of loss which may be several times as great as the small loss they have measured with such care. What the authors measured was the heating value of one pound of coal at each stage of storage. Combining this result with a determination of the percentage of moisture, ash and sulphur in the small portions withdrawn for analysis, they calculated the calorific value of one pound of pure coal substance at each stage of storage. The published data demonstrate clearly enough that one pound of the pure coal substance remaining at the end of a year developed on combustion only about 1 per cent. less heat than was developed by one pound of the original pure coal substance, but there is no evidence that the number of pounds of coal substance remaining at the end of the year was as great as the number originally placed in storage. In other words, the bulks were not weighed and the deterioration measured was only that resulting from the fixation of oxygen, no account being taken of possible loss of coal substance in volatile form. That there was such loss, the increase in the percentage of ash throughout the experiments seems to prove. Everyone with experience in the sampling of coal will recognise that the unavoidable error of a single determination of ash is high; it was this circumstance which led the authors to make their basis of comparison the heating power of a pound of pure coal substance, that is to say of ash-free, moisture-free and sulphur-free coal and not merely moisture-free coal. The figures given in the paper amply demonstrate the fact that the unavoidable error of sampling is large, but nevertheless they point almost irresistibly to the conclusion that there was a steady and far from insignificant loss of coal substance on storage.

To reduce to some extent the sampling error, the following table has been constructed from data contained in five separate Tables in the Bulletin, all referring to experiments with New River coal.

Percentage of Ash in Coal.

	Table 5	Table 7	Table 8	Table 10	Table 11	Mean
As stored...	6·68	5·67	7·97	6·08	7·45	6·8
After 3 months	7·29	5·88	8·61	6·69	8·75	7·4
,, 6 months	6·48	6·02	9·93	6·52	7·23	7·2
,, 9 months	6·70	5·71	8·45	6·12	7·79	7·0
,, 1 year	6·94	5·63	8·89	6·68	8·33	7·3
,, 1½ years	6·67	5·88	9·52	6·64	9·49	7·6
,, 2 years	7·04	6·04	10·84	8·83	9·31	8·4
,, 3 years	6·91	6·66	10·83	10·27	8·75	8·7
,, 4 years	6·90	7·14	12·49	8·55	8·60	8·7
,, 5 years	7·92	6·84	10·62	9·25	7·19	8·4

The numbered Tables referred to in the top line are the original Tables of the Bulletin and the figures in the first five columns are taken from these numbered Tables. The column of mean values has been calculated by the present writer. It should be added that the data given by Porter and Ovitz in one other Table have been excluded because the series of experiments dealt with in that Table was incomplete, also that the figures selected for presentation here are those obtained from the series of experiments with coal crushed to ¼-inch size, as the sampling error must be much less in these experiments than in those with run of mine coal.

Whilst the figures in the first five columns of the table, and even those in the last, show that the experimental error is high, those in the last column can leave no doubt that the percentage of ash increased continuously on storage. In view of the magnitude of the sampling error, which gives even the column of calculated mean values an irregular appearance, it is not proposed here to subject the figures to mathematical treatment nor to occupy space by plotting them on a system of rectangular co-ordinates. Any reader, however, can soon convince himself by either of these methods that the figures point to an increase in the percentage of ash from 6·8 to nearly 7·5 during the first year and thereafter at a gradually diminishing rate.

If this be the fact, what conclusion may be drawn from it? If a heap of coal, originally weighing 100 tons and containing 5 per cent. of ash, be sampled at the end of a year and found to contain 10 per cent. of ash, it would seem reasonable to conclude either that 5 tons of inorganic dust had entered into the heap during the year or that approximately half the coal substance had disappeared. Weighing the heap, supposing the conditions to be such that only an insignificant portion could have been blown away during the year, would decide to which of these two causes the increased ash percentage was due or the proportion due to each. In the American experiments under review, the percentage of ash did not double but it appears to have increased about one tenth in the first year and not much less in the second. If foreign inorganic dust did not gain entrance to the experimental heaps, it would appear that something like one tenth of the original coal substance had disappeared within the year. It is difficult to believe that the loss was so large as this, but since the American investigators did not weigh the coal remaining at the end of the year, it is by no means certain that the total loss on storage was not several times as great as they think to have proved it.

The point raised in this note involves an issue of such magnitude that it has been thought well to state it somewhat fully. Unless the writer is wrong, further experiments are required. These experiments need not extend over five years but they will involve considerable expense and are not likely to be undertaken except at the instance of the British Admiralty or the United States Navy Department, to which Departments the results should be of far more value than to any other class of coal user.

A NEW SIMPLE DEVICE FOR SAMPLING.

L. J. RILEY.

This device is particularly suitable for sampling dust (*e.g.*, blast-furnace dust), loose soil, earth-like material, and the like, and has for its object to facilitate obtaining a representative sample.

The end (*e*) of a tapering tube (*a*) of suitable dimensions is inserted into the material to be sampled and pushed to the bottom with a rotary motion by means of the easily removable handle (*b*) inserted through the two holes (*c*), and then withdrawn. The sample is then obtained by removing the handle and inverting the tube. The samples obtained from various parts are then mixed by a usual method for obtaining a representative sample.

This sampler is of great simplicity, is capable of easy manipulation, and ensures obtaining a sample of the material along the whole course through which it travels, as proved by tests consisting of sampling heaps of blast-furnace dust made up of approximately equal layers of dusts of different colours. Out of one hundred wagon-loads, representing every type of blast-furnace dust, sampled *vertically*, the device failed to work thoroughly satisfactorily only in the case of one very abnormal type of dust, the potash content of which was worthless.

FEDERAL COUNCIL FOR PURE AND APPLIED CHEMISTRY.

Gratifying progress has been made during the past month. The Iron and Steel Institute, one of the bodies originally invited to enter the Federation, has joined the Council. Invitations are now being sent to a number of other societies in which chemistry is of primary importance, though not the dominant interest.

A sympathetic reply has been received from the authorities of the London University to the letter the Council addressed to the Vice-Chancellor, calling attention to the inadequate initial salaries attached to chairs of chemistry at King's College and the East London College. Meanwhile, in the case of the latter college, the initial salary advertised has been raised from £600 to £750.

The representation made by the Council to the Royal Society, that the grants at the disposal of this and other societies for the purpose of chemical research are inadequate, has led the Royal Society to refer the matter to a special committee. It is the intention of the Council to go thoroughly into the whole question of the promotion of research, as there is reason to believe that the methods now in operation are in many respects ill calculated to produce the effects desired.

The representation made to the War Office and to the President of the Board of Education, that experimental science appeared to be left out of account in the Interdepartmental Committee formed to co-ordinate the educational training scheme of the Army, has also been attended with success. The President of the Board of Education and Colonel Lord Gorell agree in thinking that a scientific adviser should be added to the Committee

and the President has asked that names may be suggested. This has been done.

Considerable progress has been made in discussing the measures that can be taken to provide chemicals for research. It is proposed to put the elaboration of a working scheme in the hands of a committee on which the trade element is fully represented as well as the academic; this committee is asked to establish a permanent smaller committee and the central organisation required to give practical effect to the scheme.

Much attention is being given to the consideration of the steps most likely to promote the union of the various sections representative of the collective interests of chemical science—especially to the provision of a suitable house.

THE TRADE IN CINCHONA BARK.

B. F. HOWARD.

An article on "The Future of the Trade in Cinchona Bark" appearing in the last issue of the *Bulletin of the Imperial Institute* (XVI., Pt. 3, 1918) contains much information of value to those who desire to have an authoritative *résumé* of this important subject.

An interesting introduction traces briefly the history of the natural *Cinchonaceæ* of the forests of the Andes, and the botanical classification of the varieties best known on the market at the present day. Turning to the production of cultivated bark, the author gives the output in recent years from the plantations in the Dutch East Indies, India and Ceylon, and shows clearly the enormously important part played by the Dutch plantations in Java. In recent years, Java heads the list of producers with an annual output of 22,880,000 lb., India supplying 2,000,000 and other countries 440,000 lb. Perhaps these figures should be taken as a general indication of the pre-eminence of Java rather than as an exact comparison, for whereas the Java production is based on an average of the years 1911-1913, the Indian output given is the average of the years 1912-1913 to 1915-1916, and this must surely have been affected by the difficulties of production and shipping during the war.

The commercial or market aspect is then briefly dealt with and the efforts—successful in the main—described which were adopted to prevent over-production in the years before the war. Under a heading entitled "Trade in Cinchona Bark and Quinine," the author shows that although the Indian plantations and factories are unable to supply the needs of that portion of the Empire, yet the bulk of the imports of manufactured quinine into India have hitherto been from British sources.

A series of import and export tables follows showing the high percentage of the quinine requirements of the United Kingdom which was formerly supplied by Germany—a typical example of the position of the fine chemical industry in this country before the war, and a state of affairs which, we trust, has now gone for ever.

The great importance of local manufacture of quinine salts in Java and its possible future bearing on the world's quinine trade is not mentioned, probably owing to the complexity of the problem and the difficulty of obtaining accurate information. It is obvious, however, that no account of the cinchona industry which ignores this important factor can be considered complete.

The final portion of the article deals with bark produced in St. Helena and East Africa. Although from a commercial point of view these plantations are at the moment negligible, yet from the scientific aspect the typical analyses given are of considerable interest as they show a high percentage of quinine and prove the bark to be well up to the Java standard, thus indicating most successful cultivation—which may have been either deliberate or accidental. Viewed in detail the tables giving the results of examination of these barks appear to be somewhat inadequate and to lack uniformity. Although the total alkaloid figure and the percentage of quinine sulphate are given, a complete separation of the four principal alkaloids has apparently not been attempted. Again, the results are complicated by the inclusion of the percentage of moisture found, but as bark is valued on its alkaloid contents as shipped, moisture is not a factor of any importance. A more practical method of stating the results would be to give the percentage of (hydrated) sulphate of each of the alkaloids (quinine, cinchonidine, quinidine and cinchonine), together with the percentage equivalent of alkaloid in each case; also the sum of these figures and the amount of amorphous alkaloid. So tabulated, the results of the analyses of these very interesting samples would have enabled the reader to evaluate the barks commercially, as well as to derive useful additional scientific information from them.

NEWS FROM THE SECTIONS.

CANADA.

On January 23, Dr. A. B. Macallum, chairman of the Honorary Advisory Council for Scientific and Industrial Research, addressed one of the largest meetings ever held by the Toronto Branch of the Society. In reviewing the work undertaken by the Canadian Research Council, he described some of the problems which were of pressing national importance, such as, *e.g.*, the briquetting of lignites in Saskatchewan, the utilisation of the tar sands of Alberta, studies in re-afforestation, the organisation of guilds for industrial research, the stimulation of post-graduate work in science at universities, and the establishment of the Central Research Institute at Ottawa. It was the opinion of those present that an organised campaign or propaganda should be undertaken jointly by the Research Council and the Society of Chemical Industry in order that manufacturers, industrialists, and the public generally might be brought to understand the vital necessity for carrying on intensive industrial research along all these lines immediately.

BRISTOL.

The members of the Section attended at the University on January 23 to hear a lecture on "Explosives" by Prof. F. Francis, who gave a brief outline of the whole subject, and then referred more particularly to the events of the past four years.

In the discussion that followed, Mr. M. W. Jones, referring to lyddite, said that in the War Department specification for paints for shells the absence of lead was an essential feature, and pointed out that we owe the discovery of lyddite to an accidental and destructive explosion at the Cornbrook Works of Messrs. Roberts, Dale and Co., Manchester, in 1887. This explosion, which could not be explained at the resulting inquiry, was investigated by the late Sir F. Abel and Dr. Dupré, who finally arrived at the conclusion that the explosion was caused by the ignition of picric acid and litharge (Blue Book No. LXXV., 1887). From subsequent experiments on a large scale at Lydd, the explosive known as lyddite was evolved, and this was used for the first time during the Boer War.

EDINBURGH.

A special meeting was held on January 29, at Castle Mills, Edinburgh, by invitation of the North British Rubber Co. Ltd. Mr. B. D. Dott presided.

Mr. W. A. Williams, works manager, received the members on behalf of the company, and gave a short description of the various departments of the works which were to be visited. In speaking of the war work in which the company had been engaged, he referred particularly to the manufacture and testing of rubber-proofed fabric for balloons and airships, and paid a high tribute to the work of the chemical research laboratory in connexion therewith. The members were then conducted round numerous departments of the works, where they inspected the storing, washing, and purifying of the raw rubber, the manufacture of rubber shoes, rubber hose and tubing, etc. Much interest was taken in the special laboratory where balloon fabric is tested for its permeability to hydrogen. The fabric under examination forms a septum in a gun-metal drum immersed in an electrically heated and controlled thermostat: hydrogen is maintained at a certain pressure on one side of the fabric, and through the other division of the apparatus a uniform current of purified air is passed. The hydrogen carried over by the air is, after drying, oxidised by an electrically heated platinum spiral and weighed as water. The installation enables thirty-two tests to be carried on at the same time.

There was a large attendance of members, and the feeling was general that more of the sectional meetings might advantageously be held at works.

LIVERPOOL.

A joint meeting with the Liverpool Engineering Society was held at the Royal Institution on February 5, Prof. J. Wemyss Anderson presiding. A paper on "Electric and Oxy-Acetylene Welds and their Defects," was read by Mr. E. A. Atkins, who demonstrated the use of micro-projection by showing the structure of metals directly on a screen.

The two chief physical defects found in all kinds of welds, are low tensile strength and poor elongation, resulting in brittleness, and poor bending qualities of the joint and small resistance to fracture by shock. The tensile strength of a welded joint may vary between 5 and 100 per cent. of the strength of the unwelded piece. Although the mechanical defects are well known and easily detected, their causes are not easily discovered; in this direction microscopic research can give considerable assistance. It is of paramount importance that a welding wire (or "filling-material") should pass the most stringent chemical tests, and that its surface should be free from oxide or other foreign matter that will affect the physical properties of the weld. The alteration in the chemical composition of the welded material (in the neighbourhood of the joint) and of the filling material used, which results from the intense heat applied in the presence of air during welding, inevitably leads to considerable change in the physical properties of the joint. It must therefore be concluded that if the various processes of fusion welding are to have the wide application they deserve, some exact data must be drawn up to serve as a guide to practice. This, the author is convinced, can only be done after prolonged research. In arc-welding and in resistance-welding, the microscope readily shows up any defects, and with its aid the effects of after-heat treatment are also easily observable. Oxy-acetylene welding depends mainly for its success upon the skill of the operator. It is not sufficiently well known that mild steel is a most complex material which when subjected to high temperatures, especially in the presence of gases, can have its structure and, therefore, its physical properties, entirely altered. These defects, too, can be observed with the microscope.

MANCHESTER.

The fourth meeting of the Session was held on February 7, Mr. Wm. Thomson presiding. The honorary secretary, Mr. L. E. Vlies, announced his resignation, for business reasons, after six years' tenure of office. A brief discussion was held on the probable effects of the multiplication of Subject Groups, and it was decided to make opportunity for a full discussion.

Dr. T. J. Craig then read a paper on "The Volumetric Determination of Sulphurous Acid," The sulphite is dissolved in water and an excess of standardised hydrogen peroxide solution added. After cooling and adding dilute sulphuric acid, the excess of peroxide is found by titrating with $N/2$ permanganate. Examples were given showing results comparable in accuracy with those obtained by the iodine method. A second paper by the same author on "The Determination of Alkali in Permanganate Liquors" described a method of determining the excess of alkali at different stages during the manufacture of permanganate. The liquor is treated with neutral hydrogen peroxide until it is decolorised. After heating to decompose the excess of peroxide, a slight excess of standardised sulphuric acid is added to decompose manganite, the liquid filtered, and the filtrate and washings titrated with standard alkali at the boiling point. This gives the total alkali. By deducting the alkali equivalent to the permanganate present, the alkali present as hydroxide and carbonate is obtained. The carbonate can be found by determination in a separate portion.

Mr. J. A. Crockett and Dr. R. B. Forster described "A Device for Measuring Small Quantities of Moisture in Gases," which depends on the principle that certain fibres expand when their moisture content increases. One end of an artificial silk fibre is attached to an adjustable hook on a rod, and the other end to a series of magnifying levers connected with a pointer. The instrument is placed in a bell-jar containing the gas to be tested, and the degree of moisture is deduced from the altered position of the pointer on the scale, one division of which corresponds to a change of about 0·05 per cent. in moisture content.

At the close of the meeting a cordial vote of thanks was accorded Mr. L. E. Vlies for the excellent work he had done for the Section. During his tenure of office, the membership of the Section had increased from 290 to 520. His successor will be Mr. L. Guy Radcliffe, of the Municipal College of Technology.

YORKSHIRE.

On February 10, a paper was read by Dr. H. Ingle and Mr. Woodmansey on "Polymerised and Oxidised Linseed Oil," before a representative gathering at the Queen's Hotel, Leeds. The authors had studied the changes which took place in the production of boiled and blown linseed oil, with special reference to their permanence when exposed to air, or without exposure by mere ageing or by the action of heat. Analyses of various products at different stages were discussed, but for details the reader must be referred to the original paper. The composition of Reid's superoxidised oil was considered and various chemical theories based upon an examination of a sample of oxidised oil (linoleum scrim-lead drier) seventeen years old were advanced. The authors' main contention seemed to be the superior permanence of a polymerised oil (stout boiled) over a blown (or cold boiled) oil in paints. They also drew attention to the fact that oils containing manganese are, when dried, more liable to change than lead oils and consequently recommend for permanent paintwork —especially for artists—a stout boiled oil with a lead drier in preference to a steam-heated blown oil with a manganese drier.

NEWCASTLE.

Prof. P. P. Bedson presided over a well-attended meeting of this Section on February 12, when Mr. G. Sisson read a "Note on the Extraction of Thallium from Pyrites Flue Dust," by himself and Mr. J. S. Edmondson. At the request of the Ministry of Munitions they had first investigated their waste products from sulphuric acid manufacture with a view to recovering selenium, but they had failed to separate any appreciable quantity of it, probably because the flues from which the dust was taken were too hot.

They then turned their attention to thallium which was present to the extent of 0·25 per cent. in the flue dust. Some 15 cwt. of dust was collected, containing 4 lb. of thallium, and this represented 6 months' accumulation, or the burning of 1500 tons of pyrites containing 1 part thallium per million.

It is interesting to recollect that Sir W. Crookes discovered this element from such material, the total quantity he separated being only two grains. The method of separation depended upon the comparative insolubility of the chloride and the solubility of the sulphate. The metal was finally obtained by fusing the dried chloride with alkali cyanide and sodium carbonate. Thallium is used as a constituent of optical glass of high refractivity.

Dr. F. C. Garrett, in the absence of the authors, read a note on "The Softening Point of Pitch" by Dr. P. E. Spielmann and Mr. G. C. Petrie. The authors spoke of the difficulty of characterising by a numerical value a property which is non-existent, and stated that any test proposed must be empirical. A *résumé* was given of the various tests that had already been proposed, *viz.*: 1, Biting test; 2, change of appearance; 3, twisting test; 4, bending and sagging test; 5, powder compression by weight; 6, dropping test; 7, miscellaneous tests. The test now proposed by the authors consists in taking a block of pitch, 1½ in. long by ½ in. square section, and a rectangular piece of copper wire of 17 gauge. The wire is heated, and the foot pressed into the pitch ½ in. from one end and at right angles to the length of the block. After setting, the test piece with the wire is suspended in a beaker of water, the latter being warmed up at the rate of 1° C. per minute. The softening point is taken as the temperature at which the block of pitch turns on its axis to a nearly vertical line.

The "Newcastle Chemical Industry Club" was definitely organised at a meeting held on February 15, when the following officers were appointed:—President, Prof. P. P. Bedson; Chairman, Dr. F. C. Garrett; Hon. Treasurer, Mr. O. Smalley; Librarian, Mr. F. Hirsch; and Hon. Secretary, Mr. A. Trobridge. The above, with six other members, constitute the Committee of Management. It was resolved to secure suitable rooms in Brunswick Place, and to open a subscription list for the provision of a technical library.

CHEMICAL ENGINEERING GROUP.

The inaugural meeting and dinner of the Chemical Engineering Group of the Society of Chemical Industry will be held in the Hamilton Hall, Abercorn Rooms, Liverpool Street, London, E.C. 2, on March 21 next. The meeting will commence at 6.30 P.M., and Prof. J. W. Hinchley, chairman of the Provisional Committee of the Group, will preside. The business will include the formal adoption of the Draft Rules, copies of which have been circulated to members, and the election of Committee as prescribed by the Rules so adopted. A report of the work so far accomplished by the Provisional Committee and a statement of the position of the Group will be submitted, and the general programme of work for the immediate future will be discussed. The dinner will be served at 8 P.M., with Prof. H. A. Louis, President of the Society, in the chair. Representatives of the Government and learned Societies and Institutions, as well as leaders of education and chemical industry in this country, are expected to be present. Tickets, price 15*s.* each, exclusive of wines, may be had from the Honorary Secretary, Chemical Engineering Group, 15, New Bridge Street, London, E.C. 4, and early notification of prospective attendance is requested.

MEETINGS OF OTHER SOCIETIES.

THE CHEMICAL SOCIETY.

At the ordinary meeting held on February 6, with Dr. A. Scott in the chair, Dr. F. Challenger presented two contributions embodying work done by Prof. P. F. Frankland, himself and N. A. Nicholls. In the first, he described the preparation of monomethylamine by reducing chloropicrin with iron and very small quantities of hydrochloric acid. The experiments showed that the optimum yield of 98.5 per cent. monomethylamine is obtained by using the following proportions:—Chloropicrin 25 g., iron 50 g., water 200 c.c., and hydrochloric acid 32 c.c. The use of the theoretically necessary quantity of hydrochloric acid gave rise to much ammonia. The chloropicrin is run into the acid and iron, and after reduction, caustic soda is added, and the base distilled off with steam. The method is suitable for making large quantities of monomethylamine, such as are required in the preparation of tetryl, adrenalin, etc.

The results of an investigation of the production of monomethylaniline by reducing methyleneaniline (from aniline and formaldehyde) were also described, in addition to those obtained by the reduction of certain similarly constituted compounds. An excess of formaldehyde gave rise to the formation of much dimethylaniline.

The authors have also experimented upon methods of preparing monomethylaniline by heating aniline and methyl alcohol in an autoclave or in sealed tubes at 180° C., by the interaction of aniline hydrochloride and dimethylaniline, and of dimethylaniline hydrochloride and aniline. The yields obtained were not very good; the first method was the most satisfactory, giving yields of from 51 to 56 per cent. of the mono-derivative.

Among other papers put down for presentation but not read were two by Prof. J. T. Hewitt and W. J. Jones, entitled respectively "The Estimation of the Methoxyl Group" and "The Estimation of Methyl Alcohol in Wood Distillates and their Concentrates."

Presiding at the meeting held on February 20, Sir W. J. Pope announced the names of the Fellows who had been nominated by the Council to serve upon it during the ensuing year. Sir J. Dobbie has been nominated President. The annual general meeting will be held on March 27, at 4 P.M., and on that date the series of Anniversary Dinners, discontinued since 1913, will be revived. The dinner will be served at 7 P.M. at the Connaught Rooms, Great Queen Street, W.C., and Fellows who wish to be present should communicate with the Assistant Secretary of the Society. Among the guests will be Mr. Winston Churchill, Lord Moulton, Lord Sydenham and Mr. Herbert Fisher. The informal meeting previously arranged for the same evening has been cancelled.

A paper on "Nitro-, Arylazo-, and Aminoglyoxalines," by R. G. Fargher and F. L. Pyman, was presented by the latter.

NEWS AND NOTES.

CANADA.

British Columbia.

Vegetable Oil Industry.—The International Food Products, Ltd., of Vancouver, has arranged with a firm of chemical engineers in Chicago, U.S.A., to erect the first unit of a vegetable oil pressing plant to be located on Industrial Island in Vancouver harbour. Flax seed from the Canadian prairies will furnish the raw material at first. Other units will be erected later for pressing imported oil seeds, especially soya bean, cotton seed, coconut and palm kernel.

Minerals, Metals, Etc.—*General.*—The value of the mineral production of British Columbia in 1918 is estimated to be about $37,000,000, which is almost equal to that of 1917. The output of coal and gold increased markedly, that of copper, lead and zinc decreased, while silver and miscellaneous products changed but little.

The Canadian Geological Survey has issued a report on the mineral deposits adjacent to the Pacific Great Eastern Railway, including metalliferous ores, diatomaceous earth, talc, clays and magnesite. A summary report is included on the Lardeau and Slocan districts in which particular reference is made to the recently discovered deposits of manganese, one of which has an area of 600 × 200 ft. with a manganese content of about 48 per cent.

Copper.—The Dominion Government proposes to make a thorough exploration and examination of the copper deposits on the shores of the Arctic Ocean at Coppermine River and Bathurst Inlet.

The Britannia Mining Co. is diamond drilling a new group of copper claims several miles east of its main zone on Indian River, where stripping has disclosed already a large area of high grade chalcopyrite ore.

The Granby Consolidated Mining and Smelting Co. has struck a good grade of copper ore by diamond drilling the immense body of pyrites on the Ecstall River, a tributary of the Skeena River.

The Consolidated Mining and Smelting Co. has established at its Trail Smelter a department for the manufacture of copper rods and wires. The new plant will have a capacity of 50 tons a day, sufficient to supply the Canadian market.

Platinum.—The diamond drilling of the Tulameen River gravels by the Dominion Government has proved that platinum can be recovered in payable quantities. Further exploratory work is considered unnecessary. Assays of platinum-bearing ores and sands will be continued at the Dominion Assay Office.

Iron.—Investigations by the Dominion Geological Survey of the limonite deposits at Alta Lake indicate a surface area of 450 × 250 ft. Analyses give iron 41—48%, sulphur 0·2—1·8%, phosphorus 0·1—0·9%, and silica 1·2 to 2·2%.

Dr. A. Stansfield, professor of metallurgy at McGill University, has submitted an exhaustive report to the British Columbia Government in which he concludes that it would be economically possible to develop the electric smelting of the iron ores of British Columbia. It is estimated that 50,000 tons per annum of magnetite ore, practically free from phosphorus, titanium and copper and low in sulphur, could be delivered at a suitable smelter site. With the abundance of water-power, the cost of electrical horse-power per annum should not exceed $10. Twenty to twenty-five tons of charcoal per day could readily be obtained from the enormous supplies of sawmill waste, the charcoal thus costing from $6 to $8 per ton. Assuming power to cost $15.00 per h.p year for an experimental plant, pig iron could be produced initially at $29.75 per long ton. Government bounties are discussed and recommendations for future developments are appended. A subsequent report will describe technical details.

Carbide and Coal.—The Pacific Smelting Co. at Edmunds, B.C., has now installed a double calcium carbide furnace which will shortly be in operation.

The Granby Consolidated Mining and Smelting Co. has opened up a new coal mine at Cassidy, B.C., preparatory to manufacturing coke, etc., in new by-product recovery ovens.

The Barrett Co., of New York, has purchased a site at Marpole on the Fraser River for the erection of a plant to refine coal tar products. Negotiations are being carried on with the Granby Consolidated Mining and Smelting Co., to secure its coal tar by-products for the manufacture of materials both for local and for export trade.

AUSTRALIA.

Embargo on Copper Ore.—The Commonwealth Government has declined to allow the Pilborra Copper Fields, Ltd., Western Australia, to export copper ore to Japan on the ground that the Australian refineries are capable of treating all such ore, matte, etc., locally.—(*Official.*)

Steel Works for Western Australia.—Steps have been taken by the Australian Electric Steel Co., Ltd., to establish electric steel works at Guildford, Western Australia. The company has been exploiting the electric furnace process successfully in Sydney for the past eighteen months, and its products are high-grade steels in various forms for tools, axles, mining and other machinery. Most of the plant has been ordered from England. —(*Official.*)

BRITISH INDIA.

The Salt Industry.—In 1914 India produced about 1,203,765 tons of salt, most of which was consumed in the country for domestic and agricultural purposes, very little being available for the chemical industries. In addition to this, about 600,000 tons of salt was imported, all of which was used in Bengal, where the manufacture had failed owing to a variety of causes. From 1873 this province has practically been dependent upon overseas supplies, mainly from England. At a later date Spain and the ports on the Red Sea also sent large quantities, and in 1914 it seemed as if salt from these sources would be able to drive the English product from the market. During the war, shipping difficulties created a very serious situation in Bengal, and if the Government had not taken action, a serious crisis would have followed. As the result of investigations, two companies have recently been formed to engage in salt production. One of these, with a capital of £46,000, will have works at Contai and extract salt from sea-water by natural evaporation followed by the use of vacuum evaporators. The second company will work on a much larger scale, with a capital of £650,000. Its works will be located at Chilka Lake and its annual production will be about 500,000 tons. The process to be employed will be mainly natural evaporation, supplemented by up-to-date plant for refining and for recovering by-products, such as magnesium chloride, potassium salts and bromine. It is not proposed to use the water of Chilka Lake owing to its low salinity, but sea-water, which will be pumped into large reservoirs. Not only will the output of salt be sufficient to meet the demand for domestic consumption, but a very large proportion of it will be available for new chemical industries in Bengal, Bihar and Orissa. It thus appears that in the near future India will become independent of external sources of supply, and that salt will be available for chemical manufactures at a price which will be about the same as that which obtains in Lancashire and Cheshire.

UNITED STATES.

Developments in Chemical Industries.—*Potash in Utah.*—The chief sources of potash in Utah are the alunite deposits, the waters of the Great Salt Lake, and the cement factories. Several companies are working the alunite deposits near Marysvale and producing sulphate of potash of 95 per cent. purity, while others are making a low grade material for fertiliser purposes from the waters of the Salt Lake. Various discoveries of potash-bearing minerals and waters have been announced, but it is doubtful if their exploitation is commercially feasible. Potash recovery plants have been installed at a number of cement works, and about 1½ tons of high grade potash per day is being obtained. The total production of potash in Utah in 1916 was 35,739 tons; this year it is expected to be about 55,000 tons.

Sulphur.—In order to develop the large underground deposits near Matagorda, adjacent to the Gulf of Mexico, the Texas Gulf Sulphur Co. has recently increased its capital from \$750,000 to \$3,000,000. The erection of plant and railway sidings has already commenced.

The Dye Industry.—At a recent conference of dye manufacturers and the War Industries Board, the proposal was made that all incoming dye shipments from abroad should be imported under a licence system.

New Companies.—The total authorised capital of new chemical manufacturing companies from August, 1914, to November, 1918, is \$394,795,000. During last November 14 new companies were formed.

Platinum Substitute.—The Chemical Division of the U.S. War Industries Board has announced the discovery, at the Mellon Institute, of a new catalyst to replace platinum in the sulphuric acid contact process. A plant has been erected for producing the material on a commercial scale. The material is cheaper than platinum, and is less sensitive to "poisoning"; it has also been used successfully for the manufacture of chlorine by the Deacon process.

Glycerin Substitute. The Mellon Institute has also succeeded in producing a substitute for glycerin, suitable for use in tobacco manufacture.

Petrol Substitute.—The War Department Research Division has produced a petrol substitute ("Liberty Fuel") which is stated to have a kerosene base, and to be superior to petrol in nearly every respect.—(*Bd. of Trade J., Jan.* 23, 1919.)

Production of Rolled Zinc.—The great demand for sheet zinc for lining packing-cases for the export of munitions has led to a great increase in its production. It is now to some extent displacing copper and brass sheets as well as tinplate. The War Industries Board has ordered the substitution of sheet zinc for galvanised steel in refrigerator linings, a use which will require about 10,000 tons per annum. It is suggested that zinc should be used instead of galvanised iron for roofing, etc. The price of rolled zinc has fluctuated considerably; in 1914 it was 7—8 cents per lb., and since then it has generally varied between 15 and 20 cents, but rose as high as 33 cents in the middle of 1915. At the beginning of 1918 the Government fixed the price at 15 cents. The following statistics have been issued by the U.S. Geological Survey :—

Rolled Zinc (lb.)	1915	1916	1917
Exported*	—	25,024,182	33,027,991
Home consumption	—	70,618,102	84,224,960
Total production	90,425,811	95,642,284	117,252,951

—(*Bd. of Trade J., Jan* 23, 1919.)

* Exclusive of metal used in shipping munitions overseas.

GENERAL.

The Chemical Industry Club.—That this club is successfully meeting an urgent want is evidenced by the rapid influx of new members since it took possession of its new quarters in Whitehall Court, S.W. The membership now totals 517, comprising 371 town and 146 country members; and applications are coming in continually. At the last monthly meeting it was resolved to extend the club's hospitality to chemists who have served in H.M. Forces but who have not since entered civilian employment, by granting them honorary membership for a period of three months.

Coal Conservation.—In the course of an article on this subject in the January number of the *Edinburgh Review*, Prof. J. W. Cobb of Leeds University criticises some of the proposals regarding the establishment of electric super-stations and inferentially discusses the relative value of steam-generated electricity and coal gas as sources of heat for domestic and industrial purposes. As regards the thermal efficiency of electricity generated by steam-driven turbines, out of 100 heat units originally present in the coal only 13 are to be delivered to the consumer as electricity, 87 being lost even when the super-station efficiency claimed is attained; whereas by carbonising coal in gas works, after allowing for the heat required for carbonisation, at least 70 units become available as gas, coke and tar; and a large proportion of these 70 units can be made directly available for heating, as in a gas fire, or for generating power, as in a gas-engine. Assuming that the heat which escapes up the chimney of a gas fire is lost entirely, and that the efficiency of an electric heater is 100 per cent., the combined efficiency of the gas works plus the gas fire may be placed at 50 per cent., as against 13 per cent. for the calculated efficiency obtainable from electricity generated at one of the proposed super-stations. Above and beyond this, there is in the case of carbonisation the economic value of the chemical by-products to be considered.

The author also makes some suggestive remarks concerning possible improvements in gas manufacture. He thinks that a larger proportion of the total heat energy stored in coal should be obtained in the form of gas, *e.g.*, by gasification of the coke. It is quite possible to obtain some 50 per cent. of this heat as gas by using a mixture of two volumes of water gas and one of coal gas. The calorific power of such a mixture would be about 400 B.Th.U. The question of relative efficiency of different grades of gas is now under investigation; so far as can be seen at present, it appears that the efficiency of a gas fire or a gas ring is over a wide range independent of the thermal value of the grade of gas consumed. Prof. Cobb calculates that the exclusive use (for domestic purposes) of a gas containing 50 per cent. of the energy of the coal from which it was obtained by carbonisation, would not involve the consumption of any more coal than is now consumed by direct combustion (35 million tons); moreover, the residual coke would be available for replacing coal in other uses and the light oil, fuel oil, and other by-products would be produced in the most efficient manner known. *Per contra*, even assuming electricity to be 50 per cent. more efficient in use than gas, at least 90 million tons of coal per annum would be required to be burnt at the electric power stations to do the same work, and there would be no by-products more valuable than clinker. The above conclusions apply in the main also to industrial heating, but here the outlook is more hopeful for electricity in certain directions, particularly for high-temperature work such as steel refining and the manufacture of electrochemicals.

Oil from British-Grown Linseed.—The British Flax and Hemp Growers' Society, Ltd., having undertaken during the last few years investigations as to the possibilities of growing linseed in this country from the standpoints of yield, quality of seed, value of oil obtained, etc., have now published preliminary notes on the results obtained. The variety of seed which has been found to give the best results in so far as yield per acre and oil content is concerned proved to be that known as "La Plata" or "Plate," this seed yielding from 10—20 cwt. per acre according to the richness of the soil, with an oil-content as high as 40 per cent. This latter figure exceeds that obtainable from the imported seed, whilst the average weight of the English-grown imported seed shows a similar superiority. The high yield of oil, moreover, is successfully maintained season after season.

From an agricultural point of view it has been found that no special soil is required for the cultivation of linseed, the best results being obtained with the heavier types of loam, a high state of fertility indeed being actually found undesirable. The linseed crop follows well on a straw crop whilst wheat follows well on the linseed crop. The best period for sowing is between the end of March and the end of April, the crop being ready for harvesting about 100 days after sowing. The harvesting at this period includes both ripe and green seed, it having been shown that the oil-content of the seed is increased to the high figure above mentioned by after-ripening in the stook.

From an examination of the oil from the standpoints of its analytical constants and its behaviour in large scale practice, it is inferred that its properties may be described as those of a "super-Baltic" oil. The most notable point in the former respect is the higher iodine absorption of the English-grown oil over Calcutta oil, whilst the yield of ether-insoluble bromo-glycerides from the former exceeds even that from Baltic oil. These properties, which indicate that English-grown oil contains a higher proportion of linolenic acid than does that from Calcutta, are well confirmed by the trials carried out on a manufacturing scale, where superiority of drying power and greater rapidity of thickening on heating were found. Manufacturing trials of various types of varnishes under works conditions also showed technical advantages of the English-grown oil, a notable point being the non-tendency to "bloom" in that type of varnish which is commonly liable to this defect, and quicker drying and hardening of the more elastic varnishes.

The project of Great Britain supplying herself with home-grown linseed oil and thus rendering herself independent of Russia is shown to be feasible from an economic standpoint, the total value of a linseed crop being £23 10*s*. per acre against a cost of production of £9 per acre.

Quality of Milk Supply in Scotland.—Tables have been compiled by the City Analyst of Dundee showing the quality of the public milk supply in forty different localities (town and country) over a considerable area in Scotland. The average fat content was 3·58 per cent., and non-fatty solids, 8·82 per cent. The maximum fat content was 4·53 per cent., at Tillicoultry (Clackmannan), and the minimum 3·23 per cent., at Ladybank (Fife); the non-fatty solids were at a maximum at Cupar-Fife, 3·56 per cent., and at a minimum at Ladybank, 8·50 per cent. The localities from which the samples were taken were mostly in Fifeshire and Forfarshire.

Fatty Acids in Human Dietary.—In a lecture delivered on February 5, at King's College, W.C., on "Physiology and the Food Problem," Prof. W. D. Halliburton said that during the great shortage of fats in 1917 a special sub-committee of the Food War Committee of the Royal Society had investigated the possibility of utilising the accumulated stocks of fatty acids in the preparation of a butter substitute. The material at first utilised, although of very bad taste and smell, proved to be a suitable food for rats. The butter substitute ultimately prepared was found to be a suitable diet for human beings when alternated at intervals of one month with the fats from which the fatty acids had been prepared. The curious fact was elicited that these acids passed into the blood of the animal fed upon them in the form of fat; in other words, the glycerin was supplied by the system and the fat was synthesised in it. The increased popularity of margarine was largely due to the success achieved in imparting a very agreeable flavour to it. Margarine, prepared from vegetable oils, contains no vitamines, hence it should not be used exclusively for the children of the poor.

Utilisation of Coke Oven Gas for Town Use.—An interesting development occurred in Sheffield in December last when the city gas company took over the surplus gas from the Tinsley Park coke ovens for utilisation in its own mains. The quantity amounts to about 1,500,000 cu. ft. per day and the gas has an average calorific value of 500 B.Th.U. When Prof. W. G. Fearnsides first put the matter before the Board of Trade in 1916, the price of coke oven gas was about 9*d*. per 1000 cub. ft. compared with 1*s*. 4*d*. for coal gas (prices have since increased). The scheme has been put into operation without any extensive capital expenditure as the coke ovens are very close to the city gas main. It is anticipated that eventually the whole of the coke oven gas production will be utilised in this way, and that low grade producer gas will be used for heating the ovens. It will be remembered that Middlesbrough has used coke oven gas for town's lighting for several years past, and that the Birmingham Corporation erected a bench of Koppers ovens for a similar purpose. Like developments are expected to take place in other towns on the South Yorkshire coal field.—(*Times Eng. Suppl., Dec.*, 1918.)

Acetaldehyde Production in Norway.—The Carbide Industrial Company at Fredrikstad has recently completed a factory for the production of acetaldehyde, and the experimental work which has been in progress since July has had very good results, the daily output now amounting to 11 kilo. aldehyde. The factory will, however, shortly be able to produce 3000 to 7000 kilo. daily.—(*Tidens Tegn, Dec.* 16, 1918.)

New Method of Denaturing Spirit in Sweden.—The Union Co. has patented a new method of denaturing spirit, the great advantage of which is that the means of denaturing can be procured in sufficient quantities in the country and at comparatively reasonable prices. The raw by-products from the cellulose factories can be used straight away. Especially suitable is the material which is obtained from the distillation of turpentine. Spirit denatured in this way possesses an extremely disagreeable smell and flavour, but is not so poisonous as spirit denatured with methyl alcohol.—(*Tidens Tegn, Nov.* 28, 1918.)

Anti-Acid Coating for Iron.—If heated clean iron be exposed to hydrogen containing about 5 per cent. of silicon hydride (the gas evolved on treating magnesium silicide, $SiMg_2$, with dilute hydrochloric acid) silicon is deposited upon it as an even coating, and the protected metal will completely withstand the action of hydrochloric acid for at least two weeks. Silicon is not deposited in this manner on copper, nickel or aluminium.—(*Z. des Ver. deutsch. Ingen., Dec.* 7, 1918.)

Resumption of Alcohol Manufacture in Russia.—In view of technical, medical and military requirements, it has been decided to recommence the manufacture of alcohol. Existing stocks are very low. Potatoes unfit for human consumption are to be used exclusively, instead of 80 per cent. potatoes and 20 per cent. grain as before the war.—(*Hamburg. Correspond., Dec.* 5, 1918.)

The Russian Iron Industry and the Ukraine.—In the former Russian Empire the iron industry was mainly concentrated in three districts, of which the South Russian was by far the most important. Next in value came the Ural district and then the Polish iron fields; middle Russia and Finland were quite of minor value.

The iron and coal production of Russia in 1912 amounted to:—

	Tons, coal.	Tons, iron.
South Russia	21,284,172	5,358,553
Urals and Siberia ...	776,412	413,104
Poland	6,461,910	293,857
Middle Russia	211,302	291,236
Caucasus	68,796	—

The largest production of iron comes from Krivol Rog, South Russia, which has now been incorporated with the Ukraine Republic. The Krivol Rog output amounted to 65 per cent. of the whole Russian iron ore production, the ore containing Fe 58 to 67%, Mn 0·1%, P 0·04 to 0·08%, and SiO_2 2 to 10%. So far ore with less than 55% Fe has been rejected. Ore was occasionally exported to Germany. The total supply available has been estimated at 500,000,000 tons. Kertsch, the second largest iron district in South Russia, is situated in the east of the Crimea, and the ore here is of sedimentary origin. Two kinds of fine grained iron ore can be distinguished, which vary in colour according to the quantity of manganese they contain. Their composition is as follows:—

	Fe.	Mn.	P.	SiO_2.	As.
Yellow ore ..	40—42	1—2	1	12—14	0·01
Brown ore ...	35—37	5—7	1	13—15	0·05

The supply is estimated at 500,000,000 tons. The brown iron ores of the Donetz basin and the ores of the Korsak-Mogila are of little importance. In addition to possessing the most valuable iron-ore district, the Ukraine has also the largest and richest coal area of the South Russian Donetz basin. The new Republic has, therefore, very large deposits of both coal and iron at its disposal.—(*Stahl und Eisen, No.* 12, 1918.)

Use of Reeds in the German Textile Industry.—Now that improved processes for winning fibres from reeds have been worked out, it is safe to conclude that their use in the textile industry will remain permanent. The fine fibres which are now extracted are sufficiently soft to allow of their use in manufacturing articles of apparel. Many factories have taken up the extraction, and a number of new works have been planned for the purpose. The latter are being erected in localities where reeds are abundant, *e.g.*, in the Mark of Brandenburg, Eastern and Western Prussia, Mecklenburg, Pomerania, Holstein and Hanover. The treatment processes can generally be carried out in conjunction with agricultural work, for waste products are obtained which can be used on the land. It is estimated that up to the end of 1918, some 15 million kilo. of dry Typha fibres will have been produced from about 45 million kilo. of seeds. By systematic cultivation it is thought that the yield could be considerably increased.—(*Textil-Z., Nov.* 25, *Dec.* 3, 1918.)

The Bohemian Glass Industry.—It is reported that the German-Bohemian glass industry is threatened with partial suspension owing to shortage of silica. The silica occurring in German-Bohemia is not suitable for the manufacture of crystal glass, and the Government of Saxony has refused to allow the export of high-grade silica, of which the town of Hohenlock possesses a virtual monopoly. The threatened restricted production would be very serious as America demands glass in return for food supplies.—(*Zeit, Jan.* 12, 1919.)

Proposed University at Cologne.—The Prussian Government has sanctioned the proposal to create a university of a modern type at Cologne. The new university will be under State control, will be formed by extending scientific institutions already existing in the city, and will include four faculties, *viz.*, economic and social science, law, medicine and arts.—(*Köln. Zeit., Jan.* 11, 15, 1919.)

Ammonium Sulphate Production in Germany.—As concentrated solution of ammonia is no longer required for munition factories, the coke and gas works have been requested to cease its production, and where possible to convert their plant for the production of ammonium sulphate. The sulphuric acid needed for the latter purpose will be available, as it, too, is no longer required in munition works. The increased production of ammonium sulphate will lead to a very welcome and needed increase in the output of artificial manures. The sale of ammonia will be regulated by the Ammoniak-Verkaufs-Vereinigung of Bochum, the Badische Soda u. Anilin Fabrik, and the Upper Silesian coke works and chemical works.—(*Welthandel, Nov.* 29, 1918.)

Fire Tests on Ferro-Concrete Buildings.—In 1911 fire tests were made by the German Ferro-Concrete Committee on a number of buildings constructed of concrete reinforced by iron. A remarkable variation was found in the behaviour of several buildings constructed in the same manner and with the same qualities of materials. One building in particular was broken up by an explosive blasting action accompanied by loud detonations, pieces of the walls being projected as far as 40 m. from the building. Various explanations of this phenomenon were examined, and it was ultimately concluded that the cause was to be found in the occlusion of water in the body of the cement, but it is surmised that special conditions are required for the destructive action to take place, as this was shown in one building alone of the series that was tested. Further tests showed that the explosions could be avoided with certainty by using certain mixtures of concrete and by leaving appropriate passages in the walls for the liberation of occluded air and water.—(*Schweiz. Bauzeit., Nov.* 30, 1918.)

Prospects of the German Chemical Industry.—The suddenness of the armistice, the extent of the industry's participation in war production, and the enormous extensions of plant, make the work of transition very difficult and impose enormous financial burdens on the chemical factories. The works are in the first place resuming the manufacture of aniline dyes, the stocks of which in Germany and in other countries have greatly diminished. The great demand must first be satisfied and thereafter stocks be accumulated. In trade circles it is hoped to find foreign markets within a measurable time. Foreign competitors, apparently, will be unable to meet all the demands, so that on quantitative grounds recourse will have to be had to German products. The efforts of foreign countries are not underrated, but it is unlikely that they will have serious consequences for Germany. Competition is more likely to be felt in the simpler dyes than in the more complicated products. Switzerland, however, in the last years of the war has made great advances in connexion with the latter, and may, therefore, compete on ground which was formerly Germany's. Thus a considerable reduction in

exports—possibly as much as 40 per cent.—must be reckoned upon. Supplies of fuel and labour are sources of great anxiety. Works which enormously increased their staffs for war requirements have difficulty in keeping them occupied. The introduction of the 8-hour day, therefore, presents no special obstacle. The agreements made during the war with the explosives group for the elimination of competition in peace time are proving very useful. The chemical factories are stopping the manufacture of explosives, and the explosives works are ceasing to make intermediate products. How the works will utilise the extensive plant exclusively erected for war purposes is not yet clear. Whilst several factors combine to make the outlook far from cheerful, those in the leading circles of the industry are nevertheless free from any exaggerated pessimism.—(*Frankfurt. Z., Dec.* 7, 1918.)

Resources of Mexico.—Enormous deposits of bituminous coal exist in the State of Coahuila, but have scarcely been touched owing to transport difficulties. There are rich deposits of petroleum along the Eastern Coast, and hydro-electric power has been little developed compared with what might be done. At Conchos, to the south of Chihuahua, an isolated effort has been made to develop water power for the surrounding towns and mining centres.

There is plenty of sulphur and iron pyrites in Mexico, and much sulphuric acid is consumed; but the only important sulphuric acid factory is one owned by a United States company at Dinamita, Dgo. There are large deposits of sulphur at Conejos, between Torreon and Chihuahua, which might be developed profitably.

A modern cement plant at Hidalgo has provided for the harbour works at Tampico and Vera Cruz, and water works in Mexico City. There are inexhaustible deposits of raw material; and crude oil from the coast supplies power.

Bottles for the brewing industry are manufactured at an extensive factory at Monterey.

Dried-up lakes containing "tequesquite," a natural crude carbonate of soda, exist in different parts; also almost pure sulphate of soda from which caustic alkali can be manufactured.

There are also considerable deposits of common salt, which are controlled by an English corporation. Besides "tequesquite," there are in Sonora, 60 kilometres from the northern end of the Gulf of California, some of the largest existing deposits of almost pure carbonate of soda, which belong to the Federal Government, but for lack of transport facilities have not been exploited. Unlimited amounts of caustic soda, soda ash, and silicate of soda might be manufactured from these raw materials, and consumed within the Republic.

Mountains of phosphate rock, containing millions of tons of phosphatic material, exist in Coahuila, near Zecatecas, south-west of Saltillo, which have never been exploited for lack of transport facilities.

Ammonia, derived from oil cake produced in cotton seed industries, is being manufactured on a small scale at Dinamita, Dgo. The only nitric acid factory is situated at Dinamita. Much raw material for dyes and explosives, derived from coking at the Coahuila mines, is being wasted. All aniline dyes for wool and cotton are at present imported.—(*Bd. of Trade J., Jan.* 30, 1919.)

Melting Points of the Elements and Standard Temperatures.—In response to numerous requests, the United States Bureau of Standards has issued a table giving the melting points of the chemical elements together with a number of standard temperatures. It is pointed out that some of the values are quite uncertain; thus, while the melting point of platinum may be considered accurately known to 10° C., that of tungsten is possibly uncertain by 50° C. or more. In the subjoined tables the values have been rounded off except in cases where very accurate determinations have been made. Those substances of which the melting points, etc., are used as standard temperatures are printed in italics.

MELTING POINTS OF THE CHEMICAL ELEMENTS.

Element.	Degrees Cent.	Element.	Degrees Cent.
Helium	<—271	Neodymium ..	840?
Hydrogen ..	—259	Arsenic ..	850
Neon	—253?	Barium ..	850
Fluorine ..	—223	Praseodymium	940
Oxygen	—218	Germanium ..	958
Nitrogen ..	—210	*Silver*	960.5
Argon ..	—188	*Gold*	1063.0
Krypton ..	—169	*Copper* ..	1083.0
Xenon	—140	Manganese ..	1230
Chlorine ..	—101.5	Beryllium (Glucinum) ..	1280
Mercury ..	— 38.87	Samarium ..	1300–1400
Bromine ..	— 7.3	Scandium ..	?
Caesium ..	+ 26	Silicon ..	1420
Galium ..	30	*Nickel*	1452
Rubidium ..	38	Cobalt ..	1480
Phosphorus ..	44	Yttrium ..	1490
Potassium ..	62.3	*Iron*	1530
Sodium ..	97.5	*Palladium* ..	1549
Iodine	113.5	Chromium ..	1615
Sulphur ..	S_I 112.8; S_{II} 119.2; S_{III} 106.8	Zirconium ..	1700?
Indium ..	155	Columbium (Niobium) ..	1700?
Lithium ..	186	Thorium ..	>1700 <Mo.
Selenium ..	217–220	Vanadium ..	1720
Tin	231.9	*Platinum* ..	1755
Bismuth ..	271	Ytterbium ..	?
Thallium ..	302	Titanium ..	1800
Cadmium ..	320.9	Uranium ..	<1850
Lead	327.4	Rhodium ..	1950
Zinc	419.4	Boron ..	2200–2500?
Tellurium ..	452	Iridium ..	2350?
Antimony ..	630.0	Ruthenium ..	2450?
Cerium ..	640	Molybdenum ..	2550
Magnesium ..	651	Osmium ..	2700?
Aluminium ..	658.7	Tantalum ..	2900
Radium ..	700	*Tungsten* ..	3400
Calcium ..	810	Carbon ..	> 3600
Lanthanum ..	810?		
Strontium ..	>Ca<Ba?		

OTHER STANDARD TEMPERATURES.

Substance.	Phenomenon.	Degrees Cent.
Oxygen	Boiling	—183.0
Carbon Dioxide	Sublimation ..	— 78.5
Sodium Sulphate $Na_2SO_4+10H_2O$	Transformation into anhydrous salt	32.384
Water	Boiling	100
Naphthalene	,, ...	217.96
Benzophenone	,, ...	305.9
Sulphur	,, ...	444.6
Ag_3Cu_2	Eutectic freezing	779
Sodium Chloride	Freezing	801

—(*U.S. Com. Rep., Jan.* 16, 1919.)

Fuller's Earth in the U.S.A.—The fuller's earth industry in the United States first assumed commercial importance in 1895; at the present time the production is about eleven times and the value nearly nineteen times, greater than it was then.

The quantity, value and average per ton of fuller's earth sold in 1917 in the United States were the largest on record, the increase in quantity being 4200 short tons, or 7 per cent., and in value £14,000 or nearly 10 per cent. over 1916.

The amount and value of the fuller's earth produced in the United States in 1917 were more than four times as great as those of the imported earth, and formed 81 per cent. of the total as compared with 80 per cent. in 1916. The average price of the domestic earth (43*s.* 4*d.* per short ton) was 1*s.* 2*d.* per ton more than the imported earth, and 1*s.* per ton above the average in 1916. The total quantity of fuller's earth imported in 1917 was 14,000 tons, an increase of 160 tons over 1916.

Fuller's earth is widely distributed in the United

States, but it was mined and marketed only in the following States (mentioned in the order of their importance):—Florida, Georgia, Texas, Massachusetts, Arkansas and California—98 per cent. of the earth being marketed in the Southern States in 1917. Fuller's earth is now little used for its original purpose of fulling cloth; its chief use is in bleaching and filtering fats, greases and oils, the manufacture of pigments and as a toilet powder.—(*U.S. Geol. Surv., Sept.*, 1918.)

Camphor Production in Japan.—The production of camphor in Japan and Formosa for the year ending March 31, 1918, was 4,854,000 kilo., of which 4,710,000 kilo. was sold through the National Camphor Monopoly Bureau.—(*Chem.-Z., Dec.* 28, 1918.)

World Production of Chromium Ore.—The following table gives the output of chromium ore, containing an average of about 50 per cent. of chromic oxide, in the principal producing countries:—

Metric tons	New Caledonia	Rhodesia	Canada	U.S.A.
1906	57,307	3,308	7,936	109
1907	31,552	7,273	6,528	294
1908	46,890	12,118	6,554	364
1909	40,000	37,024	2,470	606
1910	40,000	40,002	279	208
1911	82,806	47,000	143	122
1912	51,516	62,850	—	204
1913	63,370	63,384	—	259
1914	48,852	49,009	123	601
1915	67,000	61,590	11,196	3,326
1916	74,116	88,871	24,522	48,943
1917	?	?	36,352	41,000

—(*Wirtschaftsdienst, Jan.* 10, 1919.)

LEGAL INTELLIGENCE.

SOAP TRADE DISPUTE. *Lever Bros., Ltd.* v. *Brunner, Mond and Co., Ltd., and Others.*

In the Court of Appeal, on February 10, Brunner, Mond and Co., J. Crosfield and Sons and W. Gossage and Sons appealed from an interim injunction granted recently by Mr. Justice Bray, at the instance of Lever Bros. and Associated Enterprises, Ltd., restraining defendants from adopting a scheme for reorganising the capital of J. Crosfield and Sons and W. Gossage and Sons.

Mr. Upjohn, for Brunner, Mond and Co., said that in July 1917 Lever Bros. and his clients compromised litigation in which they were engaged in regard to a pooling agreement by a contract under which Lever Bros. were to acquire half of the ordinary share capital in Crosfields and Gossages from Brunner Mond, and in return to transfer to Brunner Mond preferred ordinary shares in Lever Bros., Ltd. Neither of these transfers had yet been carried out and litigation had been started in respect of the agreement. Lever Bros. claimed that with Brunner Mond they were entitled to control the policy of Crosfields and Gossages, and further that the directors of these two companies nominated by Levers should not only learn all the trade secrets of the companies but should be at liberty to disclose these to their nominators. Both contentions the defendants strenuously denied. After the armistice was concluded, Crosfields and Gossages, in view of expanding trade, both discussed the desirability of adding to their capital, and a scheme was prepared by Crosfields' Board for reorganising the capital of that company.

Sir John Simon, for Lever Bros., argued that by the compromise of July 1917 his clients had obtained equality with Brunner Mond in the direction and control of the business of Crosfields and Gossages. The action was being brought to define the nature of the control thus obtained.

The Master of the Rolls, in giving judgment, said that for the last 18 months proceedings had been in abeyance in respect of the agreement of July 1917, because when the plaintiffs prepared a draft agreement the defendants introduced matters which in the plaintiffs' view were entirely new. As a result an action was now pending and Lever Bros. did not own or hold any shares in Crosfields or Gossages. Crosfields had prepared a scheme of capital reorganisation of which details had been given. The scheme was a *bona fide* one and there was nothing said against it except that it might prejudicially affect some interest of Lever Bros. Lever Bros.' action was brought to obtain two declarations. In regard to the first, Lever Bros. had not at present been excluded from any control. In fact they had never been in a position to exercise or nominate directors. As to the second, the duties of directors were regulated by statute. The proposed reorganisation of capital was urgently necessary, and yet it had been disturbed at the instance of persons who were not shareholders. The injunction should never have been granted and must be dissolved.

Lord Justice Scrutton and Mr. Justice Eve concurred.

The appeal was accordingly allowed, the injunction dissolved, and an inquiry directed as to damages.

PRE-WAR ENEMY CONTRACTS. *Borax Consolidated, Ltd.* v. *Chemische Fabrik auf Aktien vorm. E. Schering and Others.*

Before Mr. Justice Roche in the King's Bench Division, on February 10, Borax Consolidated, Ltd., asked the Court to declare void, as from August 4, 1914, certain pre-war contracts relating to the supply of raw material for the manufacture of borax and boric acid to the defendants, who were refiners. The contracts covered a period of 10 years from January 1, 1913.

His Lordship, in giving judgment, said the case was fully covered by authority, and he must decide in favour of the plaintiffs, and grant the declarations which they sought. The defendants relied on a suspensory clause in the agreement, but that clause did not refer to a war like the present one, and even if it did the agreement would be contrary to public policy.

A similar judgment was given in another group of cases (Borax Consolidated, Ltd. *v.* Eisenhütte Silesia A.-G. and Others).

FAILURE OF A FIRM OF MANUFACTURING CHEMISTS. *Pickard, Ive and Rankin, Ltd.*

The compulsory winding up order against Messrs. Pickard, Ive and Rankin, Ltd., of Notting Hill, London, was made on the petition of the Abbey Chemical Co., Ltd., in October last. The statement of affairs filed in the proceedings disclosed liabilities of £35,234 and assets estimated to produce £12,119 and a total deficiency as regards contributories of £16,112. The company was registered as a private company in 1916 with a nominal capital of £3025, and was formed *inter alia* to carry on the manufacture of antipyrin and aspirin by methods stated to have been discovered by Pickard and Rankin. In 1917, the company acquired by purchase from the same, secret processes for manufacturing para-nitraniline, pure ortho-anisidine, guaiacol, and acetic anhydride. Disputes arose with the Abbey Chemical Co., Ltd., in connexion with contracts for the supply of chemicals, and when these were arbitrated upon, the company was liable for £4400. The failure is attributed by Pickard to want of sufficient capital to pay the damages awarded in the arbitration.

The Receiver reports that negotiations are pending between him and proposed purchasers for an offer of substantial amount to be submitted for the company's assets.

At the statutory first meeting of creditors and shareholders, held on February 11, a liquidator and a committee of inspection were appointed.

APPLICATION FOR EXCLUSIVE USE OF ENEMY PATENT.

Before the Comptroller of Patents on February 7, an application was made by the Liquid Air and Rescue Syndicate, of London, for an exclusive licence to use the German patent No. 1663 of 1912, for an "improved metallic vessel for liquefied gases," the patentee being C. W. P. Heylandt, of Hamburg. The invention was a bottle with a thin flexible neck which allowed of the ready discharge of the contents, no siphoning being required. The applicants said that they had been selling the vessels under an agreement with the patent owners, but had now erected a plant for the putting together of them for the sale of liquid air.

The Comptroller said that he would hesitate to grant an excusive licence unless special reasons were shown; he would communicate the decision in due course. A case had certainly been made out for a licence, and applicants could come to the Court and oppose anybody else's application.

PARLIAMENTARY NEWS.

HOUSE OF COMMONS.

Munition Factories.

Mr. F. C. Kellaway, replying to Mr. Kennedy Jones, said the process of reconversion of war factories to civil uses was making steady progress in many districts. A more speedy change was hindered by the uncertainty as regards the future prices of raw materials, industrial unrest, and, until recently, by inability to secure the demobilisation of skilled men.—(Feb. 13.)

Electric Power Supply

Mr. W. C. Bridgman, in answer to Mr. Rose, said he hoped it would be possible to introduce a Bill dealing with the reorganisation of electric power supply at an early date. Full consideration is being given to the question of ownership of the super-stations, but he did not think that provisions relating to the price of coal could be included in such a measure.—(Feb. 17.)

Alsatian Potash.

Capt. Sir B. Stanier asked whether the Government was taking steps to secure the importation of potash salt from Alsace into this country. Sir A. Griffith-Boscawen replied that no arrangements have yet been made, but the Government is conferring with the French Ministry of Agriculture on the subject.—(Feb. 17.)

The Fine Chemical Industry.

Mr. Herbert asked the President of the Board of Trade if he is aware that the manufacture in this country of certain fine chemicals, such as saccharin, which was started during the war with the support of the Government as a key industry of national importance, is seriously threatened by the removal of restrictions on import or the removal by foreign countries of restrictions on export; and whether he will consider the advisability of restricting the import of such fine chemicals, in order to preserve the new industry in this country pending the proposed legislation against dumping and for protection of key industries.

Mr. W. C. Bridgman replied that the whole question as to the means to be adopted for the maintenance of new industries is now engaging consideration, and he hopes that it will be possible to make a statement on the subject shortly.—(Feb. 19.)

Sewage Sludge.

In reply to questions put by Lieut.-Col. Sir J. Norton Griffiths concerning the utilisation of sewage sludge, Major Astor stated that the present price of the dried sludge marketed by the Rivers Department of the Manchester Corporation is 53*s*.—55*s*. per ton, f.o.r. During 1918, 1349 tons of this material was sold, representing 8000 tons of wet sludge out of a total of 264,000 tons produced. It is not possible to cause local authorities to develop schemes for the utilisation of waste sewage; but a small committee, upon which the Local Government Board is represented, is at present looking into the question.—(Feb. 19.)

REPORT.

REPORT OF THE ENGINEERING TRADES (NEW INDUSTRIES) COMMITTEE. MINISTRY OF RECONSTRUCTION. [Cd. 9226. 6*d*.]

The Committee was appointed in December 1917 to compile a list of articles suitable for manufacture by the engineering trades, which were either not made in the United Kingdom before the war or were made only in small quantities. The method of procedure adopted was to form a number of branch committees to study and report in detail, leaving the main committee to make general observations with regard to the conditions under which new industries should be set up.

General Observations.—The chief difficulties that hinder the British manufacturer are (1) Financial embarrassment due to the excess profits tax; (2) inability to give long credit to foreign customers; and (3) competition from large and well established undertakings abroad. As methods of improving the prospects of success in new enterprises, the Committee recommends: (1) The wide adoption of specialisation and standardisation; (2) the fuller development of the National Physical Laboratory and the wider dissemination of the results of its research work among manufacturers; (3) the holding of exhibitions, with Government support, of articles not previously made in this country; and (4) the education of both employers and workpeople, —the former in the adoption of modern quantity production, and the latter in removing the deep-seated impression that quantity production creates unemployment. The Labour Advisory Committee recommends that no new industry should be established unless good wages can be paid, neither should industries be introduced that involve special liability to industrial disease to the workers. It is further pointed out that the obligation on employers to pay fair wages involves a corresponding obligation on the part of the workpeople to give a fair return.

Of the Branch Committees' Reports the following are of interest to the chemical industry.

Chemical and Dye-making Machinery.—The heavy chemical trades were strongly established before the war and all the ordinary chemical plant was produced in this country. The electrolytic plant in connexion with bleach and caustic soda manufacture was of the best and latest type. Oleum manufacture was developed only to a very small extent, but in order to meet the requirements of explosives production, it has been greatly increased, and a number of very large Griller-Schroeder plants have been built. The Committee found that such plant as multiple effect evaporators, centrifugals, homogeneous lead linings, grinding mills, vacuum stills, aluminium vessels, electric motors and dye plant were being satisfactorily

produced in this country. Great developments have taken place in the production of acid-resisting silicon iron, but a metallic alloy that satisfactorily resists hydrochloric acid has still to be found. The filter press, although a British invention, was largely manufactured in Germany and imported in large numbers before the war. All the home and colonial needs can now be met by British manufacturers. Vacuum drying ovens are now made in this country of superior design to the German type previously imported. The lining of metallic vessels with glass and vitreous enamel requires further research work before really satisfactory products can be obtained. Autoclaves for carrying out caustic and other fusions at high temperature and pressures up to 500 lb. per square inch are now being made in quantity.

Scientific Apparatus. In pre-war times our dependence on foreign productions was largely due to the foreigners having free access to our markets without any reciprocal advantage on our side. During the war great strides have been made in the production of instruments for military use, and the Committee is of the opinion that we possess the necessary manufacturing, technical and labour facilities for securing a leading place in the world's manufacture of scientific apparatus provided that we meet foreign competition on equal terms. It recommends that no foreign apparatus be imported into the Empire except under licence for a period of 10 years. A very important element necessary to the establishment of this industry is greater specialisation by the makers, which would promote economy and efficiency in production and allow of co-operative selling to be arranged by non-competing firms. German chemical balances have been sold to a great extent in this country under the names of English dealers; microscopes were supplied by Germany, United States and Italy; saccharimeters and refractometers came almost entirely from Germany. All these very important instruments can be produced in this country if proper encouragement be given. It is estimated that the types of labour required for their production are, approximately, equal numbers of skilled men, unskilled men, and women.

Carbon Manufacture.—An account of this industry is given in an appendix. The Witton Carbon Works was laid down in 1902 by the General Electric Co. and until quite recently was the only factory of its kind in the kingdom. The difficulties encountered, such as obtaining plant and raw materials (tar and lampblack), educating workpeople and accumulating the necessary technical knowledge, were increased by the policy of price-cutting immediately adopted by the Continental producers. As a result of this, in two years prices were reduced by one half, and by 1914 the company had lost over £70,000. Since the outbreak of war the manufacture of carbons in this country has been fully justified, for otherwise serious difficulties would have arisen in meeting the requirements of arc carbons for searchlights. The company's soot factory has been much enlarged, and it is now producing material not only for carbon manufacture but for other very important industries developed during the war. In the future it is estimated that the demand for arc carbons will decline, and that the Witton Works, as now extended, will be able to supply the Empire's needs. The manufacture of carbon electrodes for electric furnaces and electrolytic work is one of increasing importance, and is being developed by the General Electric Co. and other firms. Every encouragement should be given to the production of electrodes, which must be regarded as a key industry. Carbon dynamo brushes have been successfully made by the Morgan Crucible Co. since 1905, and during the war the entire supply for the electrical industry has come from this source.

GOVERNMENT ORDERS AND NOTICES.

PROHIBITED EXPORTS.

Further alterations in the existing regulations have been announced as follows:—

Headings transferred from one list to another.

From List A to List C:—

Aerated and mineral waters; jute yarns; hair, animal, and tops noils, mixture waste and yarns thereof; tin and alloys of tin; tin ore. Chemicals: Cream of tartar; phosgene (carbonyl chloride); tin, oxide of.—(Feb. 6.)

Asbestos, raw, crude and open fibre; bones in any form and bone ash; leather waste; manures, organic; rattans. Chemicals: Radium and its compounds.—(Feb. 13.)

From List B to List C:—

Iridium and its alloys and manufactures containing iridium. Chemicals: Tin, compounds of, except chlorides and oxide of tin.—(Feb. 6.)

Altered Headings.

(A) Fats, all animal and vegetable; (C) articles and mixtures containing fats, not otherwise prohibited; (A) fatty acids; (C) articles and mixtures containing fatty acids, not otherwise prohibited; (A) kapok; (C) fibres, vegetable, not otherwise specifically prohibited; (A) feeding stuffs containing molasses; (C) molasses; (A) wool grease; (C) articles and mixtures containing wool grease, not otherwise prohibited.—(Feb. 13.)

Exports to Norway, Sweden, Denmark and Holland.—The Director of the War Trade Department has announced that the quantities of certain goods which may be imported by the above countries under the agreements with the Allied Governments, have been largely increased. The goods specified include many chemical products (*v. Bd. of Trade J.*, *Feb.* 6, 1919).

Exports without Licence.—The list of goods which may now be exported to all non-enemy destinations without application to the War Trade Department, or the production of certificates, etc., which are usually required for exports to neutral countries in Europe, has been extended and will shortly be the subject of a new Proclamation (*v. Bd. of Trade J.*, *Feb.* 13, 1919).

Resumption of Trade with various Countries.—Permission has been granted, by Royal Proclamation, for the resumption of commercial transactions with the following countries, etc.:—Finland, Alsace-Lorraine, Czecho-Slovakia, Austria-Hungary (occupied territories), Germany (occupied territories on left bank of the Rhine), Serbia, Rumania, Siberia, Turkey (including Turkey in Europe, Asia Minor, Armenia, Kurdistan, Mesopotamia and Syria), Bulgaria and Black Sea Ports.

NEW ORDERS.

The Priority of Work (Partial Suspension) Order, 1919. Ministry of Munitions, February 7.

The Railway Material (Second-hand) (Partial Suspension) Order, 1919. Ministry of Munitions, February 7.

New Maximum Prices for Imported Timber, under the Timber Control Order, 1918, as from February 10, 1919. Board of Trade, February 1.

Orders Cancelled by Notice.—The Raw Cotton Order, 1917, and the Cotton (Restriction of Output) Order, 1918, as from February 3. Board of

Trade, February 4. The Raw Goatskins Order, 1918. War Office.

Revocation of Proclamation.—The Proclamation of July 28, 1915, prohibiting the importation of unset diamonds into the United Kingdom, was revoked by a Royal Proclamation on February 10, 1919.

OFFICIAL TRADE INTELLIGENCE.

(*From the Board of Trade Journal for February* 6 *and* 13.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 73 Basinghall Street, London, E.C. 2, from firms, agents, or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

Locality of Firm or Agent	Materials	Reference Numbers
Calcutta	Paints, varnishes, chemicals and patent medicines	194
Colombo	Nitrogenous manures ...	207
Ontario...	Coal tar distillates, tanners' oils and greases, soluble gums, etc.	192
Vancouver	Chemicals, glass, gelatin, tinfoil	189
Johannesburg ...	Enamelware, galvanised iron, paper	185
"	Glycerin, sodium cyanide, paper	183/166
Belgium	Chemicals, drugs, paper...	202
Ste. Marie aux Mines, Haut Rhin	Dyes	226
La Baneza, Spain	Chemical manures, minerals	182
Lausanne	Chemicals, sugar, cocoa, oilcakes	197
Messina	Margarine	175
Palermo	Soap, perfumes, paper ...	228
Sao Paulo, Brazil	Drugs	217
Sao Paulo and Rio de Janeiro ...	Heavy chemicals, pharmaceutical products	184

Canadian firms able to supply ferrochrome and chromite concentrates upon a large scale wish to get into touch with importers in the U.K. Inquiries to The Canadian Government Trade Commissioner, 73 Basinghall Street, E.C. 2.

South African firms able to export hides, skins and talc wish to get into touch with importers in the U.K. Apply to The South African Government Trade Commissioner, 90 Cannon Street, E.C. 4.

An opportunity exists at present for the establishment of a coconut factory in North Borneo, where over 20,000 acres are under coconut. An oil-press of modern design and a factory for dealing with the many by-products are badly needed. Particulars from The Secretary, British North Borneo Co., 37 Threadneedle Street, E.C.

TARIFF. CUSTOMS. EXCISE.

Alsace-Lorraine.—A Ministerial Decree dated January 30 defines the Customs *régime* in Alsace-Lorraine.

Australia.—The prohibition of the importation of certain goods in tinplate containers is withdrawn.

British Honduras.—The import of firearms and ammunition is prohibited, except in accordance with a special permit, from January 3 to December 31, 1919.

Canada.—New regulations for determining the strength of imported acetic and pyroligneous acids and vinegar for Customs duty came into force on January 1.

France—Netherlands. Several commercial agreements have been denounced.

Gold Coast.—The prohibition of exportation of cocoa to the U.K. is cancelled as from December 23.

Morocco (*French Zone*).—The export of vegetable hair (*crin végétal*) is now permitted.

Netherlands.—The export of pumice-stone and freestone is prohibited as from January 16.

Russia.—The Customs Tariff at Odessa for imports from the U.K., British Dominions, and Allied Countries is the general tariff of 1915 and the conventional tariff which came into force in September last.

Spain.—The export of ground nuts is limited to 100,000 quintals for the present year and an export duty of 13 pesetas per 100 kilo. has been levied thereon as from January 24.

United States.—The Export Conservation List, revised to January 16, includes ammunition, oilcakes and feeding stuffs, lard and compound lard, condensed milk, hydrogenated cottonseed oil, manufactures of gold, quinine, and sugar.

Licences for the import of all commodities hitherto controlled, with few exceptions, may now be issued without the clause requiring endorsement to any Trade Association.

A new Import Licence known as "P.B.F. 31" has been issued to cover all in transit shipments of unrestricted goods where shipment was made from abroad after January 21.

Recent rulings of the War Trade Board affect many chemicals, animal and vegetable oils, paraffin, paints, varnishes, minerals, foodstuffs, beverages, metals and their ores, paper, glue, bones, horns, tanning materials, dyewoods, synthetic indigo, and gutta percha.

COMPANY NEWS.

GAS LIGHT AND COKE CO.

The ordinary general meeting of the proprietors was held on February 8, Mr. D. Milne Watson, governor and managing director, presiding. In the course of his address, Mr. Watson said that notwithstanding a diminution of 7 per cent. in the output of gas, the expenditure had risen from £6,000,000 to £6,691,000, the result of increased costs of raw materials and labour, the latter accounting for about one-half of the total increase. The price of gas had accordingly to be raised to 4*s.* 4*d.* per 1000 cu. ft. at midsummer, a rise of 73 per cent. over the pre-war figure, but much less than the rise in the price of raw materials. The price of coal has gone up 100 per cent., fire bricks 118 per cent., timber 224 per cent., lubricating oil 293 per cent. Parliamentary sanction was obtained to permit the company, and other companies working under the sliding scale, to pay a dividend equal to three-fourths of its pre-war dividend, excluding all accruing under the scale; hence it was now proposed to pay a dividend at the rate of 3 per cent. per annum for the past half year. The decrease in the company's business above alluded to was mainly due to the Orders relating to the rationing of gas, the last Order in particular having enormously damaged the industry. During the war the company has taken a prominent part in the supply of raw

materials for explosives manufacture. Seventeen million gallons of oils and 13,000 tons of disinfectants were supplied to the services, and over five million gallons of tar was provided for road construction in France. The company's steamers now number only 6 owing to 12 having been lost by enemy action. Nearly 5000 of the employees have been serving with the colours and about 500 have lost their lives. Since the issue of the June Order the quality of the gas supplied has averaged 486 B.Th.U., a reduction of 7 per cent. below the pre-war figure. With regard to the proposals to develop greatly the supply of electricity, the gas industry claimed to participate in any financial aid that might be forthcoming from the State. Where light and power are concerned, gas and electricity have their joint and several fields, but where heat is required the case for gas is overwhelming, alike in cost to the consumer and in economy of coal to the nation.

SOUTH METROPOLITAN GAS CO.

Addressing the ordinary half-yearly meeting on February 12, Dr. Charles Carpenter, the chairman, dealt at length with the work undertaken by the company in the prosecution of the war. Attention was first directed to the manufacture of dye intermediates, but this work was soon interrupted by the more imperative demands of the explosives industry. Within two months a plant was running for the production of the material required. When, in 1916, a serious shortage of toluene for making T.N.T. arose, the company submitted a scheme for the rapid utilisation of all the gas works in the country. In a very short time the industry had completely organised itself for this purpose, and the nation undoubtedly owes much to it for the magnificent response it made to the appeal. Almost all the charcoal required for gas-masks was produced at the West Greenwich works; and at the close of hostilities a factory designed to prepare material for lethal gases was on the point of production. Only one of the six gas works was struck by an enemy bomb, and the damage was quickly repaired. On the other hand, the largest gas holder, containing 8 million cub. ft. of gas, was wrecked and some chemical plant damaged by the Silvertown explosion. Ten of the company's ships were sunk by enemy action. No hindrance was placed in the way of employees who wished to enlist, with the result that of the 6600 workers and officials employed before the war, 3744 joined up. The resulting labour shortage was overcome by the excellent work of the women dilutees. For a year the trade union fought against the employment of women in retort houses. "Trade Unionism has either been betrayed or has betrayed itself during the Great War."

Dealing with present-day difficulties, Dr. Carpenter said that the cost of coal and labour had risen to a figure alarming in the extreme, and hopes must be centred upon a general solution being found by the Government. Compared with 1913, the company had paid £1,075,380 more for coal and freight, and £483,751 more for wages, although the gas consumption was 4·3 per cent. less. If State aid is to be given to the electrical industry, it must also be forthcoming to gas undertakings, for these utilise coal to better advantage than can even be promised by the advocates of electric super-stations. The gas industry, however, must put its own house in order, and *inter alia* it is essential that gas should be sold on the basis of its calorific power. Another important consideration is the remuneration of capital invested in gas undertakings, for it cannot be denied that the present rate is both insufficient and inequitable.

TRADE NOTES.

BRITISH.

The Plumbago Situation in Ceylon.—H.M. Trade Commissioner in Calcutta reports that the plumbago industry in Ceylon is at present in a difficult position owing to the elimination of the United States as a market; and it is feared that with the rapidly-increasing competition from Madagascar, the Ceylon industry is to some extent imperilled. While exports remained fairly steady until the year 1917, during the first nine months of 1918 they decreased by almost 50 per cent. As the United States, however, must be short of stocks it is considered that there should be a revival in demand before the coming spring. The total exports in 1907 were 32,026 tons, of which the United Kingdom took 8507 tons, the United States 14,170 tons, Germany and Austria 4884 tons. In 1917 the United Kingdom took 4602 tons, and the United States 21,964 tons. In 1918 (Jan. 1—Oct. 4) the United Kingdom received 3826 tons, and the United States 14,415 tons.—(*Bd. of Trade J., Feb.* 13, 1919.)

British Industries Fair, 1919.—The British Industries Fair, organised by the Board of Trade, was opened in the Pennington Street premises of the London Dock on February 24, and will remain open until March 7. The number of firms exhibiting is 570, of which 114 represent the glass and pottery trades. The Fair is confined to trade buyers, the general public not being admitted.

Analysis of Pre-war Chemical Imports.—The method used by the Board of Trade for recording the imports into the U.K. of chemicals and drugs involved their sub-division into two main groups, as shown by the following lists for 1913:—

I.—Imports of Chemical Manufactures and Products (other than Drugs, Dyestuffs and Manures).

	£
Acetate of lime	49,342
Acetic acid (other than for table use)	85,790
Acetone	162,633
Bleaching materials:	
Bleaching powder	32,189
Other sorts	2,183
Boracite	39,743
Borate of lime	148,187
Borax	15,029
Brimstone	92,712
Carbide of calcium	272,445
Coal products, not dyes	164,447
Cream of tartar	331,974
Glycerin, crude	255,718
Glycerin, distilled	84,570
Muriate of ammonia	9,953
Potash compounds:	
Saltpetre (nitrate of potash) ...	240,966
Other sorts	630,234
Soda compounds:	
Soda ash	894
Soda bicarbonate	940
Soda caustic	4,692
Soda crystals	5,202
Other sorts	160,322
Sulphuric acid	8,960
Tartaric acid	247,377
Unenumerated	1,488,034

II.—Imports of Drugs Containing no Dutiable Ingredient.

	£
Bark, Peruvian	58,003
Cocaine and cocaine salts	14,378
Morphia and morphia salts	32
Opium	507,262
Quinine and quinine salts	102,102
Unenumerated (including medicinal preparations)	1,302,860

Owing to the very large proportion of substances classed as "unenumerated" or "other sorts" such lists convey relatively little information. Of the chemicals in I., valued at £4,534,536, 50·3 per cent. was "unenumerated," and of the drugs in II., valued at £1,984,637, 65·6 per cent. Since 1914 the need for fuller information has been felt, and the Board of Trade, in conjunction with the Statistical Office of the Customs, has analysed the principal unenumerated items. The results are given below:—

(a) POTASH COMPOUNDS—OTHER SORTS.

Article.	Total Imports in 1913.	Of which: Imports from Germany	Other Principal Sources of Supply.	
	£	£	£	
Potassium Bromide ...	8,708	7,909	799	U.S.A.
,, Carbonate ...	108,650	33,909	68,499	Russia.
			10,315	France.
Potash—Caustic and Lyes	116,252	90,806	12,832	France.
			8,827	Belgium.
Potassium Chlorate ...	26,324	2,101	14,020	France.
			6,595	Sweden.
,, Cyanide ...	10,342	9,763	—	—
,, Iodide ...	41,217	10,361	30,654	Japan.
,, Muriate ..	100,457	99,996	—	—
,, Perchlorate ...	6,122	—	3,880	Sweden.
			1,242	France.
,, Permanganate	7,715	7,451	—	—
,, Phenylglycine	38,832	38,832	—	—
,, Prussiate ...	34,289	14,781	15,201	France.
			3,244	Belgium.
,, Sulphate ...	88,089	85,175	1,601	France.
,, Sulpho-Muriate	22,935	22,935	—	—
39 Other Sorts	21,402	17,427	—	—
Total of above ...	630,234	441,436	—	—

(b) SODA COMPOUNDS—OTHER SORTS.

Article.	Total Imports in 1913.	Imports from Germany	Other Principal Sources of Supply.	
	£	£	£	
Sodium Acetate	14,487	6,388	4,645	Belgium.
			2,030	U.S.A.
,, Chromate and Bi-chromate ...	20,730	20,649	—	—
,, Chlorate	19,716	642	14,614	France.
			3,414	Spain.
,, Glycero-Phosphate	5,776	5,716	—	—
,, Hydrosulphite ...	26,361	16,377	9,930	France.
,, Hyposulphite ...	7,128	7,122	—	—
,, Nitrite	10,067	1,168	5,406	Norway.
			2,957	France.
,, Perborate ...	6,222	6,222	—	—
,, Phosphate ...	9,5[illegible]1	6,183	3,096	Belgium.
,, Salicylate ...	16,147	15,264	845	France.
39 Other Sorts	24,097	14,162	—	—
Total of above ...	160,322	99 783	—	—

(c) CHEMICALS—UNENUMERATED.

Article.	Total Imports in 1913.	Imports from Germany	Other Principal Sources of Supply.	
Aluminium Compounds:	£	£	£	
Sulphate...	50,861	35,909	11,923	Belgium.
Hydrate...	4,854	4,510	344	Netherlands.
Alum	3,645	2,196	1,294	Netherlands.
Other	9,462	4,406	4,925	Australia.
Ammonium Compounds:				
Nitrate	51,166	461	43,339	Norway.
Oxalate	10,179	9,919	—	—
Perchlorate	4,180	—	3,673	Sweden.
Phosphate	6,017	1,300	3,149	Belgium.
Other	3,582	2,960	318	Belgium.
Antimony Compounds:				
Sulphide	11,327	8,388	2,909	France.
Other	7,396	5,791	1,605	France.
Arsenic	40,741	3,230	13,146	Belgium.
			8,447	Australia.
			8,402	Portugal.
			6,966	France.
Baking Powder	26,803	1,500	25,303	U.S.A.
Barium Compounds:				
Binoxide...	19,050	14,614	4,436	France.
Chloride...	10,452	7,389	2,262	Belgium.
Other	13,162	12,344	567	Netherlands.
Boracic Acid and Powder	51,115	1,154	32,274	France.
			14,316	Italy.
Bromine and Compounds	12,380	12,380	—	—
Butter Colouring	7,294	303	3,436	Denmark.
			2,335	Netherlands
Camphor	105,669	1,656	101,616	Japan.
Carbonic Acid Gas ...	12,805	9,955	2,581	Netherlands
Chromium Compounds (except Chromic Oxide)	4,294	3,076	919	Belgium.
Citric Acid	23,161	10,787	6,475	France.
			4,678	Italy.
Copper Compounds:				
Copper Oxide	25,711	24,768	—	—
Other Sorts	6,732	3,043	1,631	France.
			1,021	Italy.

(c) CHEMICALS—UNENUMERATED—(cont.)

Article.	Total Imports in 1913.	Of which: Imports from Germany	Other Principal Sources of Supply.	
	£	£	£	
Disinfectants	14,239	13,762	211	U.S.A.
Formaldehyde	9,449	6,609	2,137	Netherlands.
Formic Acid	42,949	35,028	7,636	Netherlands.
Glanz Gold	35,506	14,106	21,401	Belgium.
Hardening Powder ...	6,540	4,586	1,954	Netherlands.
Iodine	80,432	465	70,703	Chile.
			8,064	Peru.
Lactic Acid	13,809	10,910	2,631	Netherlands.
Lead Compounds:				
Acetate	29,398	15,861	9,067	Netherlands.
Other	1,477	1,449	—	—
Lime Compounds:				
Citrate	60,418	—	54,192	Italy.
			6,079	Br. W. Ind.
Other	1,272	1,272	—	—
Magnesium Compounds:				
Chloride	25,656	25,669	—	—
Other	1,828	1,065	390	Netherlands.
Nitrate of Soda*	166,704	12,000	127,009	Chile.
			21,945	Belgium.
Oxalic Acid	20,083	18,166	1,887	Norway.
Phosphorus	23,866	81	19,243	Canada.
			4,542	France.
,, Compounds ...	573	241	286	U.S.A.
Photographic Chemicals ...	12,140	11,948	—	—
Rennet	12,115	1,372	9,246	Denmark.
Salicylic Acid	10,621	10,293	225	Switzerland.
Silver Nitrate	29,031	2,587	26,444	France.
Sodium	9,499	—	9,302	Norway.
Sulphur Compounds:				
Dioxide	7,277	7,255	—	—
Chloride	3,112	3,096	—	—
Other	1,453	1,433	—	—
Tartar Crystals, Tartar and Compounds	17,396	306	17,085	Italy.
Thermit	6,656	6,656	—	—
Thorium Nitrate	41,544	23,078	16,668	France.
			1,798	Austria-Hungary.
Tin Chloride	10,646	10,354	—	—
33 other items ranging in value from £5000 down to £1000	68,931	43,336	—	—
390 items under £1000 in value	54,419	33,111	—	—
Various details unspecified	147,967	116,559	—	—
Total of above	1,488,034	614,372	—	—

* The bulk of the imports of Nitrate of Soda is recorded under "Manures."

(d) DRUGS—UNENUMERATED.

Article.	Total Imports in 1913.	Imports from Germany	Other Principal Sources of Supply.	
(i) Manufactured or Prepared:				
Albulactine	7,074	7,074	—	—
Aspirin	19,799	19,677	—	—
Epsom Salts	8,602	6,534	983	Belgium.
Ergot of Rye	15,846	3,280	6,945	Russia.
			2,664	Spain.
Guaza (Ganja)	7,168	392	6,623	Br. India.
Hæmoglobin	6,624	64	6,543	Switzerland.
Magnesia	18,055	10,741	3,872	U.S.A.
Menthol	63,108	3,128	56,306	Japan.
			2,200	France.
Aniseed	25,304	335	16,767	Hongkong.
Cod Liver	101,044	501	88,986	Norway.
			7,651	Netherlands.
Eucalyptus	37,865	528	33,821	Australia.
Other	2,563	528	—	—
Proprietary Articles:				
Patent Medicines ...	172,519	77,435	90,225	U.S.A.
Emulsion	39,563	—	39,447	U.S.A.
Liniment	10,439	—	10,439	U.S.A.
Ointment	19,482	12	19,438	U.S.A.
Pills	6,993	1,146	1,900	U.S.A.
			3,540	France.
Plasters	26,910	1,294	25,493	U.S.A.
Other	6,050	351	1,670	U.S.A.
Papain	6,766	27	6,446	Ceylon.
Pepsin	5,679	538	5,011	U.S.A.
Phenacetin	7,951	6,183	1,349	Switzerland
Salvarsan and Neo-salvarsan	11,383	11,383	—	—
Sugar of Milk	16,226	7,160	6,526	Netherlands
Tartar Emetic	6,067	4,766	240	Belgium.
31 other drugs ranging in value from £5000 to £1000	53,218	22,703	—	—
306 other drugs ranging in value upto £1000 ...	72,669	36,117	—	—
Items unspecified	141,600	79,103	—	—
Total of above ...	915,547	301,000	—	—

(d) DRUGS—UNENUMERATED.

Article.	Total Imports in 1913.	Of which: Imports from Germany	Of which: Other Principal Sources of Supply.	
(ii.) Leaves, Roots, Seeds, Barks, etc., raw or simply prepared :	£	£	£	
Aloes	18,424	365	13,034	Cape of Good Hope
			2,712	U.S.A.
Aniseed	11,206	835	8,712	Russia.
			2,294	France.
Asafœtida	5,072	-	3,430	Persia.
			1,256	U.S.A.
Balsams	12,052	3,161	3,304	U.S.A.
			1,989	Brazil.
Buchu Leaves	7,684	-	7,547	Cape of Good Hope
Calabar Beans	5,504	216	5,231	Sierra Leone
Cardamoms	47,939	339	35,323	Ceylon.
Coca Leaves and Powder	5,873		3,125	Java.
			2,025	Ceylon.
Feungreek Seed	18,336	38	0,747	Egypt.
			5,499	Turkey in Asia.
			4,789	Morocco.
Herbs, unspecified ...	18,935	5,092	5,662	France.
			5,069	Japan.
Nux Vomica	13,764	-	12,760	Br India.
Quassia	8,511		8,005	Br. West Indies.
Roots :				
Gentian	5,508	50	5,084	France.
Ipecacuanha	33,675	3,695	12,651	Uruguay.
			5,696	Brazil.
Licorice (incl. Powder and sticks)	8,199	738	2,816	France.
			1,635	Italy.
			1,077	Turkey in Asia.
Orris (incl. Powder) ...	6,303		3,316	Morocco.
			2,868	Italy.
Rhubarb...	11,287	198	10,572	China.
Sarsaparilla	10,882	165	6,927	Panama.
			2,055	Br. West Indies.
Senega	8,373	1,634	3,982	U.S.A.
			2,755	Canada.
Unspecified	7,516	1,853	2,322	U.S.A.
			2,141	France.
Sandalwood	5,136	8	5,428	Netherlands.
Senna	17,384	189	13,132	Br. India.
			3,254	Egypt.
15 other items ranging in value from £5000 to £1000	10,790	6,851	—	—
98 other items each under £1000	55,680	6,037	—	—
Total	387,313	31,164	—	—

From the above figures it is seen that 70 per cent. of the unenumerated potash compounds came from Germany, 60·4 per cent. of the sodium compounds, and 11·3 per cent. of the chemicals—unenumerated. Of the unenumerated drugs, 25·5 per cent. was imported from the same country.—(*Bd. of Trade J., Feb.* 6, 1919.)

FOREIGN.

Sugar Production in Santa Clara, Cuba.—The production of sugar in Cuba during 1917-18 was 3,446,083 long tons, and about one-fourth of this quantity came from the province of Santa Clara. A production at least equal to this is forecasted for 1918-19, but labour shortage may seriously affect output. The price for the forthcoming crop has been fixed at $5·50 (£1 2*s.* 7*d.*) per 100 pounds, f.o.b. Cuban ports. Inactivity of the molasses market is attributed to American Prohibition.—(*U.S. Com. Rep., Dec.* 13, 1918.)

Organising the Metal Industry of Finland.—The Finlanders are rousing themselves to protect and strengthen their staple industries. According to the *Hufvudstadsbladel*, an association of representatives of the metal industry has been formed at Helsingfors to organise and direct the import and export trade, and to promote new undertakings in connexion with the metal industry.—(*Metall u. Erz, Nov.* 8, 1918.)

A National Fair for Finland.—At a recent meeting of the National Industrial League of Finland it was decided, in accordance with a suggestion made by the Commission of Commerce and Industry, to organise a national fair, or exposition, to be held at Helsingfors or Tammerfors during the summer of 1919.—(*U.S. Com. Rep., Dec.* 21, 1918.)

The Bordeaux Fair of 1919.—The date of the Third Sample Fair has been fixed for May 16 to 31, 1919. Applications for space, regulations, etc., should be made to the Comité d'Organisation et Administration de la Foire de Bordeaux, Hôtel de Ville, Bordeaux, France.

Opportunity for Chemical Trade in Mexico.—There is considerable opportunity for chemical trade with Mexico, in which British exporters have at present no share. This applies more particularly to drugs, aniline dyes, acids and heavy chemicals for use in mines. A German firm at present manufactures some sulphuric, nitric and hydrochloric acids, and superphosphates; whilst dyes, formerly supplied by Germany, are now imported from the United States. British pure chemicals are unknown in Mexico, and a British exhibition, especially of dyes, would be welcomed.—(*Bd. of Trade J., Jan.* 30, 1919.)

Markets for Soda Products in Latin America.—In consequence of war demands, the output of caustic soda in the United States has been doubled since 1914, and the industry is now seeking markets for the large surplus available for export. The various states of North, Central and South America have been studied from this point of view. At the present time the best markets for sodium products (mainly caustic soda, soda ash and sodium silicate) are Argentina, Uruguay, Paraguay, where the meat packing industry produces a large amount of tallow. Large quantities of caustic soda are imported by these countries for converting this tallow into soap. In 1917 Argentina alone imported over 23,000,000 kilo. of soda products, the bulk of which came from Great Britain. In addition to some 200 soap factories, this country also possesses a considerable number of paper mills. In Brazil, where, it is stated, there are 91 soap factories and 161 cotton mills, the shortage of caustic soda has been so great that the Government is now encouraging local production. The west coast countries are for the most part occupied in mining, and there is no great demand for soda. Local soap manufacture is carried on in Chile and Peru, which import about 2,000,000 kilo. and 1,000,000 kilo. respectively of caustic soda. As agricultural conditions prevail in most of the countries of Central and Northern America, most commodities are imported in the fully manufactured state and there is little demand for industrial chemicals. In Mexico there should be a fair market for soda products as soon as the country becomes settled again; before the revolution over 8,000,000 kilo. of caustic soda was imported annually.—(*U.S. Com. Rep., Dec.* 16, 1918.)

Magnesite in the Salonica District (Greece).—The increasing demand for magnesite has led to shipments during the past two years from the peninsula of Chalcidice. Of the five localities where magnesite is obtainable, Yerakino is the most important; the deposits there have been worked since 1905 and are still far from being fully developed. Before the war, the ore was calcined and shipped to Holland, whence it was re-shipped to various other countries. The annual shipments of calcined ore amounted to 10,000 metric tons, representing 21,000 tons of the crude ore. In addition, 2000 to 3000 tons of the crude ore was

exported to Italy, France and Holland. On the outbreak of war, shortage of fuel stopped the calcination. In 1916, the exports to Holland had fallen to 320 tons of crude ore and 730 tons of calcined ore, while no exports to that country are on record for 1917. The United States received 12,914 tons of crude ore in 1916, but none in 1917. The British Government was the principal purchaser, the shipments in 1915, 1916 and the first half of 1917 amounting to 40,000 tons, at an average price of 30*s.* to 50*s.* per ton, f.o.b. Yerakino. An increase in price made in July, 1917, however, has practically stopped further sales.—(*U.S. Com. Rep. Supp., Oct.* 2, 1918.)

REVIEWS.

L'Aluminium dans L'Industrie. *By* Jean Escard. *Métal pur, Alliages d'Aluminium. Pp.* 272. *(Paris: H. Dunod et E. Pinat,* 1918.) *Price* 14 *frs.* 40 *c.*

In spite of the fact that aluminium has now, 92 years after its discovery, become one of the most important metals in common use, and in spite of the continuous growth of the proportion of current periodical literature which it monopolises, the text books devoted to this metal remain remarkably few in number, and, it must be added, disappointing in quality. English readers are confined to the original publication of Richards which was written when the electrolytic process of production was still in its infancy, and to Waldo's translation of Minet's very inadequate "Die Gewinnung des Aluminiums und dessen Bedeutung für Handel und Industrie." In the German language there is further, Mierzinske's "Die Fabrikation des Aluminiums" of 1885, and a short treatise by Winteler, "Die Aluminium Industrie" written sixteen years ago, whilst France has given us the original work of Sainte Claire-Deville "De L'Aluminium" published in 1859, Moissonier's "L'Aluminium," dating from 1903, and finally the book now under review.

This poverty is doubtless due to the fact that the number of workers who have actual experience of the metallurgy of aluminium and at the same time the scientific and technical equipment necessary to enable them to pass their knowledge on is still very small, whilst most of those who could do so are debarred by vows of secrecy or heavy pre-occupations. To this must also be ascribed the fact that most of the books referred to above are unsatisfactory in that they do not bear the impress of first hand knowledge or accurate information.

Escard's book forms no exception in this respect. It is true that according to his title the author limits himself to a description of the applications of aluminium and its alloys to industry, but in point of fact he has attempted the much more ambitious task of writing a text book on the metal. As a scientific treatise the book suffers from the defect that no critical consideration appears to have been given to the various processes, observations or data enumerated, and the author consequently makes himself responsible for describing as being in actual operation methods of manufacture which never got further than the laboratory or the patent office, gives as the physical properties of the metal values which have long ago been discarded, and recommends it for uses for which it has been shown to be unsuited, whilst neglecting modern developments. The book is also unscholarly in that the author seems to shut his eyes to much of the work which has been done upon aluminium outside of France, whilst he gives but sparingly the names of authors whose work he does use or references by which their original communications can be consulted. Thus in his opening paragraph dealing with methods of manufacture in current use no room is found for the name of Hall.

In his first chapter Escard describes the nature and origin of the raw materials used in the manufacture of aluminium, and gives an account of the production of the metal and statistics of production and consumption. The figures given of yields, output, consumption of electrodes, etc., should be accepted with caution.

In his second chapter the author describes the physical, mechanical and chemical properties of the metal, whilst one section deals with soldering and welding, and another with methods of working. Here the author has been entirely misled by his unquestioning acceptance of the figures of others. The account given of the work of Heyn and Bauer upon the effect of atmosphere and waters upon aluminium is welcome, as this research, which merits close study, is inaccessible to most English readers. Although the next chapter contains a good description of the "Thermite" process, it is on the whole disappointing. Ten lines cover all that the author finds to say about the use of aluminium for aircraft, and he still recommends the use of aluminium for the hulls of boats and ships! An adequate account is given of the manufacture of aluminium powder with illustrations of the machines used, which have not been published here before. The process of coating other metals with aluminium, which is known as "Calorising," is described, whilst the Schoop process of spraying metal coatings on to various objects also finds mention. The claims made for the aluminium coating thus produced (p. 108) cannot, however, be conceded.

More than half the book is made up of a description of alloys of aluminium which, whilst catholic in its embrace, does not discriminate between just and unjust claims, or between useful and useless alloys. Thus twelve pages are devoted to the zinc-aluminium alloys, while as many lines serve to convey all the information given about the light ternary zinc-copper-aluminium alloys which form the bulk of all the alloys of aluminium in actual use. There is a section dealing with Duralumin, but the heat treatment of this material and its amazing effects on the metal are not considered worthy of mention.

A full table of contents at the end of the book does not make up for the lack of an index.

Richard Seligman.

A Short Hand-book of Oil Analyses. *By* Augustus H. Gill. *Revised eighth edition. Pp.* 209. *(Philadelphia and London: J. B. Lippincott Company.) Price* 10*s.* 6*d. net.*

This little hand-book has been proved, by the exhaustion of seven editions in 21 years, to have met a demand, which, to judge from its contents, must have been chiefly on the west side of the Atlantic. It is in two parts, of which the first relates to physical and chemical tests, very many of which, as described, are peculiar to the North American continent. For instance, the Abel flash-point apparatus, the Redwood viscosimeter, etc., are not described, and, except for a few graphs of comparative readings of different viscosimeters given in an Appendix, there is no relation indicated between them and the corresponding American standard testing apparatus. On this account, the first part of the book, though good within its limitations of space and scope, is not likely to be much used in Great Britain.

The second part of the book, on the derivation, description and examination of certain oils, is of more cosmopolitan service. But in many respects

it is disappointing. Example being better than precept, it is useless for the author to say on one page (in the first part) that, in expressing viscosity it is necessary to give the name of the instrument with which it is determined, and later to cite figures for the viscosity of oils and greases for various lubricating purposes without indicating—so far as the reviewer can discover—the instrument to which they refer. Presumably they are, like certain viscosities given in the Appendix, for the "Saybolt universal" viscosimeter, but the reader should not be left at the mercy of guesswork in a matter of this kind. This and other similar failings suggest that the text is unlikely to be of much direct service to the analyst or user of oils, though indirectly he may find the book quite useful for its foot-note references to original papers, reports, etc. The text will serve well the purpose of the general student who merely requires a compact review of the characteristics and methods of testing the commoner oils—mineral, vegetable and animal.

W. J. A. BUTTERFIELD.

PUBLICATIONS RECEIVED.

RECENT ADVANCES IN PHYSICAL AND INORGANIC CHEMISTRY. *By* A. W. STEWART. *With an Introduction by* SIR WILLIAM RAMSAY. *Third edition. Pp.* 284. (*London: Longmans, Green and Co.* 1919.) *Price* 12*s.* 6*d.*

TRATTATO DI CHIMICA GENERALE ED APPLICATA ALL' INDUSTRIA. VOL. I.—CHIMICA INORGANICA. PARTE SECONDA. *By* DR. E. MOLINARI. *Pp.* 1190. (*Milano: Ulrico Hoepli,* 1919.) *Price* 26 *lire.*

PHARMACEUTICAL AND MEDICAL CHEMISTRY. A TEXT-BOOK OF CHEMISTRY INTENDED FOR THE USE OF PHARMACEUTICAL AND MEDICAL STUDENTS. *By* S. P. SADTLER, V. COBLENTZ, *and* J. HOSTMANN. *Fifth Edition. Pp.* 765. (*Philadelphia and London: J. P. Lippincott Company.*) *Price* 21*s.* net.

BULLETIN OF THE IMPERIAL INSTITUTE. VOL. XVI. *No.* 3. *July-September,* 1918. (*London: John Murray.*) *Price* 2*s.* 6*d.*

INTRODUCTORY LECTURE TO THE CLASSES IN METALLURGY IN THE ROYAL TECHNICAL COLLEGE, GLASGOW. *Session* 1918-1919. *By* PROF. C. H. DESCH. (*Glasgow: J. Maclehose and Sons.* 1919.)

NOTES ON FLAX. *Issued by the British Flax and Hemp Growers' Society, Ltd.* (*Registered Office:* 14, *Victoria Street, S.W.* 1.) I.—*The Cultivation of Flax in Great Britain.* II.—*The Separation of Vegetable Fibres.* III.—*Linseed as a Farm Crop in Great Britain.* IV.—*The Cultivation of Flax for Fibre in Great Britain.* V.—*The Cultivation of Flax for Seed in Great Britain.* VI.—*Oil from British-grown Linseed.* VII.—*The Isolation of Improved Strains of Flax Seed for Sowing Purposes.*

REPORTS I. AND II. ON COSTS AND EFFICIENCIES FOR H.M. FACTORIES CONTROLLED BY FACTORIES BRANCH, DEPARTMENT OF EXPLOSIVES SUPPLY. *Pp.* 79 *and* 134. (*H.M. Stationery Office.*)

STATISTICS OF THE SYNTHETIC DYESTUFFS IMPORTED INTO THE UNITED KINGDOM DURING THE YEAR 1913. *Report of the Commissioner for Dyes, Board of Trade. Pp.* 168. (*H.M. Stationery Office.*)

FOUR YEARS' WORK. *An Account of the Progress of the Coal-tar Chemical Industry during the War. Pp.* 23. (*Levinstein Ltd., Manchester.*)

DYES AND OTHER COAL-TAR CHEMICALS. *Report of the United States Tariff Commission, Recommending Amendments to Title V. of Act of September* 8, 1916. *Pp.* 83. (*Washington: Government Printing Office.* 1918.)

INDIGENOUS DRUGS OF INDIA. *Their Scientific Cultivation and Manufacture, with Suggestions for the Development of New Industries. By* J. C. GHOSH. *Pp.* 32. (*Calcutta: Butterworth and Co., Ltd.* 1918.) *Price* 12 *annas* (1*s.*).

REPORT ON THE BUILDING AND ORNAMENTAL STONES OF CANADA. VOL. V., PROVINCE OF BRITISH COLUMBIA. *By* W. A. PARKS. *Pp.* 236. (*Ottawa: Government Printing Bureau.* 1917.)

MINERAL SPRINGS OF CANADA. PART II., THE CHEMICAL CHARACTER OF SOME CANADIAN MINERAL SPRINGS. *Bulletin No.* 20. *By* R. T. ELWORTHY. *Pp.* 173. (*Ottawa: Government Printing Bureau.* 1918.)

NATURAL GAS: ITS PRODUCTION, SERVICE, AND CONSERVATION. *By* S. S. WYER. *Bulletin* 102, *Part* 7, *of the Smithsonian Institution, United States National Museum. Pp.* 67. (*Washington: Government Printing Office.* 1918.)

THE PRODUCTION OF PRECIOUS STONES FOR THE YEAR 1917. *By* G. F. KUNZ. (*Reprinted from Mineral Industry, Vol. XXVI.*) (*New York: McGraw-Hill Book Co., Inc.,* 1918.)

SOILS OF SOUTHERN NEW JERSEY AND THEIR USES. *By* J. A. BONSTEEL. *United States Department of Agriculture Bulletin No.* 677. *Pp.* 78. (*Washington: Government Printing Office.* 1918.) *Price* 40 *cents.*

PUBLICATIONS OF THE UNITED STATES BUREAU OF MINES. DEPARTMENT OF THE INTERIOR. (*Washington: Government Printing Office,* 1918.)

ROCK QUARRYING FOR CEMENT MANUFACTURE. *By* O. BOWLES. *Bulletin* 160. *Mineral Technology* 22. *Pp.* 160. *Price* 25 *cents.*

MELTING BRASS IN A ROCKING ELECTRIC FURNACE. *By* H. W. GILLETT *and* A. E. RHOADS. *Bulletin* 171. *Mineral Technology* 23. *Pp.* 131. *Price* 20 *cents.*

COLLOIDS AND FLOTATION. *By* F. G. MOSES. *Technical Paper* 200. *Price* 5 *cents.*

ECONOMIC OPERATIONS OF STEAM TURBO-ELECTRIC STATIONS. *By* C. T. HIRSHFELD *and* C. L. KARR.

HOW TO IMPROVE THE HOT-AIR FURNACE. *By* C. W. BAKER.

PUBLICATIONS OF THE UNITED STATES GEOLOGICAL SURVEY. DEPARTMENT OF THE INTERIOR. (*Washington: Government Printing Office.* 1918.)

FLUORSPAR AND CRYOLITE IN 1917. *By* E. F. BURCHARD.

ASPHALT, RELATED BITUMENS, AND BITUMINOUS ROCK IN 1917. *By* J. D. NORTHROP.

GOLD, SILVER, COPPER AND LEAD IN ALASKA IN 1917. MINES REPORT. *By* G. C. MARTIN.

STONE IN 1916. *By* G. F. LOUGHLIN.

INTERNATIONAL CONTROL OF MINERALS. *By* C. K. LEITH.

THE ECONOMIC LIMITS TO DOMESTIC INDEPENDENCE IN MINERALS. *By* G. O. SMITH.

PEAT IN 1917. *By* C. C. OSBON.

MAGNESIUM IN 1917. *By* R. W. STONE.

SOCIETY OF CHEMICAL INDUSTRY.

ANNUAL REPORTS OF THE PROGRESS OF APPLIED CHEMISTRY.

Volume III. of Reports of the Progress of Applied Chemistry is now in the press and will be published before the end of the present month. The reports included in the volume review the literature of the various subjects for the year 1918 in most cases, though in certain sections the work of earlier years is also considered. Two new sections are included in this volume, *viz.*, those on Agricultural Chemistry and on Foods, whilst several other sections have been contributed by fresh authors so as to give readers the advantage of reviews written from a somewhat different point of view. The sections on ceramics, building materials, and fermentation industries are not included, as the authors failed to send in their MSS. in time.

The following is a list of the sections of the volume and their authors: Plant and machinery; J. W. Hinchley. Fuel; J. T. Dunn. Gas, destructive distillation; Alwyne Meade. Mineral oils; Arnold Philip. Colouring matters and dyes; G. T. Morgan. Fibres, textiles, cellulose, paper; J. F. Briggs. Bleaching, dyeing, printing, finishing; S. H. Higgins. Acids, alkalis, salts, etc.; H. A. Auden. Glass, refractories; W. J. Rees. Metallurgy of iron and steel; C. O. Bannister. Metallurgy of the non-ferrous metals; G. Patchin. Electro-chemistry; A. J. Hale. Fats, oils, and waxes; C. Revis and E. R. Bolton. Paints, pigments, varnishes, and resins; L. M. Nash. India-rubber; D. F. Twiss. Leather and glue; F. C. Thompson. Agricultural chemistry; E. J. Russell. Sugars, starches, and gums; J. P. Ogilvie. Foods; H. W. Bywaters. Sanitation, water purification; E. Ardern. Fine chemicals, medicinal substances, essential oils; G. Barger. Photographic materials and processes; B. V. Storr.

The volume, which contains over 500 pages, may be obtained from Messrs. Spottiswoode, Ballantyne and Co., 1 New Street Square, London, E.C. 4; price to members 5*s.* 6*d.*, post free.

Volumes I. and II. may still be obtained, as announced recently in the Journal (Jan. 15, 1919, p. 1 R).

LIBRARY FACILITIES.

It has already been mentioned in the "Journal" that our Society has contributed £100 to a scheme proposed by the Chemical Society, whereby certain other societies might enjoy the privileges of its Library. Under the arrangements made, all members of the Society of Chemical Industry are entitled to use the Library of the Chemical Society, subject to the observance of the Library Rules applicable to Fellows of the Chemical Society. The Council of our Society, in drawing the attention of members to the valuable privilege thus afforded them, expresses the hope that they will make the fullest possible use of the facilities provided. The following digest of the Library Rules at present in force is given for the guidance of our members, and indicates the scope of the library service afforded them.

The Library is housed in the Chemical Society's rooms at Burlington House, Piccadilly, London, W. 1, and opens at 10 a.m. every weekday, and closes on Tuesdays and Fridays at 9.0 p.m., on Saturdays at 5.0 p.m., and on other days at 6.0 p.m. It is closed on Bank Holidays and the day following, and for a fortnight annually (for cleaning, etc.). The Library may be used, during the hours it is open, by members of our Society, for reference, and for borrowing books, not exceeding six at one time. Dictionaries and certain other reference and exceptional books may not ordinarily be taken out on loan, and journals (unless the Society has duplicate copies) may be borrowed only for one night or from Saturday to Monday. The latter must, however, be personally applied for 10 minutes before the usual hour of closing, and must be returned not later than 1 hour after the hour of re-opening on the following day. Books newly acquired may not be had on loan until one month has elapsed. All members entering the Library sign in a book provided, and borrowers sign a voucher which is given back when the book to which it refers is returned. Books are also issued on loan on receipt of a written order, the borrower paying the whole cost of carriage. Books are lent at the borrower's risk; he is liable to make good books lost, detained or damaged. A book may be retained for one calendar month unless the borrower is notified to return it earlier, but single parts of journals must be returned within one week. Books will not be sent out of the United Kingdom.

The full Library Rules are exhibited in the Library, and applications for the loan of books, by members who cannot call for them, should be addressed to the Librarian of the Chemical Society, Burlington House, Piccadilly, W. 1, and should state that the application is made in virtue of membership of the Society of Chemical Industry.

COMMITTEE ON THE STANDARDISATION OF LABORATORY GLASSWARE.

The Council of the Society, acting upon a suggestion made by Dr. Morris Travers when reading his paper on Scientific Glassware at the annual meeting of the Society at Bristol in July last, has appointed the following Committee to deal with the question of the standardisation of laboratory glassware:—Sir Robert Hadfield, Bart., Sir Herbert Jackson, Mr. Kenneth Chance, Dr. C. Carpenter, Mr. W. F. Reid, Dr. Morris Travers (Convener), with the President and Honorary Treasurer of the Society as *ex officio* members.

This Committee, at its first meeting, felt that it would be of great importance before proceeding further to obtain the views of the glassware manufacturers, the users, and the retail trade. They therefore approached the Council with the object of obtaining permission to secure the co-operation of representatives of these bodies, and this being granted, the following additional members have now been added to the Committee:—Mr. G. F. Baker (British Lamp-blown Scientific Glassware Manufacturers' Association), Mr. F. W. Branson, of Leeds, Mr. D. J. P. Berridge (Public School Science Masters' Association), Dr. J. J. Fox (Government Laboratory), Mr. J. R. Griffin (British Laboratory Ware Association), Mr. Arnold Stevenson (Glassware Supply, Ministry of Munitions) and Mr. V. Stott (National Physical Laboratory).

The Committee has already had several meetings and a considerable amount of important work has been accomplished.

All communications regarding the Committee should be addressed to the General Secretary at the Society's offices.

CHEMICAL COMPOUNDS FOR THE DETECTION OF OVERHEATED MACHINERY AND BEARINGS.

H. T. PINNOCK.

It is an axiom, theoretically established and proved practically, that some degree of friction and consequent heat generation is inseparable from machinery in motion. Half a century ago, breakdowns of machinery from this cause were more the rule than the exception, but with modern improvements in design and construction and more specialised knowledge of lubrication and lubricants, trouble from this cause has been reduced to an extent that was previously thought impossible. There can, however, be few, if any, industrial undertakings where trouble has not, at some time been caused by overheated bearings and the like; trouble due to dirt, inattention, or failure of the lubrication system. Such occurrences, even to-day, are not infrequent and the result may often mean a complete or partial stoppage of the machinery involved, coupled with expensive repairs owing to "galling" of the moving parts. Trouble of this kind naturally occurs most frequently with machinery in inaccessible places; for instance, in a line of overhead shafting, the first visible indication may be the emission of blue smoke from the overheated oil in the vicinity of the bearings, by which time both bearing metal and shaft may be badly galled.

It is obvious that if warning could be given as soon as heating up occurred, but before it became serious, much trouble and expense could be avoided and the matter could be rectified in time. With this object in view, various devices have been introduced from time to time, which have consisted mostly of indicators operated by thermo-electric couples, or of expansion methods. Tonner, in America, suggested the use of copper mercuric iodide on the axles of railway rolling stock as an indicator of overheating. This suggestion, however, does not appear to have been carried out to any extent; it is difficult to see why, as under suitable conditions some such compound appears admirably suited to the purpose.

The attention of the writer was directed to the matter about 1908, and he was then in ignorance of Tonner's suggestion, but was led to investigate the properties of the double iodides of mercury with other metals, for the purpose of finding a suitable compound which would serve as a detector of overheated bearings. These double iodides were all found to possess the property of undergoing a reversible transition involving change of colour when heated and subsequently cooled. With most of them the change was comparatively slow, and the transition was so gradual and spread over so large a range of temperature as to be unsuitable for the purposes required. Other compounds changed fairly sharply, but the range of colour passed through was too slight to be of any practical value.

Two compounds were, however, eventually prepared which gave promise of considerable utility. The first of these was the double iodide of silver and mercury, $AgI.HgI_2$, which is a pale lemon yellow powder at ordinary temperatures, and changes to a vivid carmine colour at about 90°—100° C. the change in both directions being fairly sharp. The other was the copper mercuric iodide, $Cu_2I_2.2HgI_2$, which Tonner had previously described. This substance is a very vivid scarlet vermilion at ordinary temperatures and at 60°—70° C. it changes to a chocolate brown. Both these compounds are adapted for use under suitable conditions, but it was found that a mixture of the two, consisting of 85 per cent. of the copper salt and 15 per cent. of the silver salt, was more sensitive and gave a greater colour range from vermilion to almost black, the transition being exceedingly sharp. (Other mixtures were prepared for special conditions, but the above was more generally applicable.)

The compounds may be prepared in a variety of ways; for instance, a very simple method of preparing the copper salt is by well triturating in a mortar 380 grams of cuprous iodide with 910 grams of mercuric iodide, sufficient water being added to form a paste. When thoroughly mixed, the mass is dried in the water oven, and the dried mass ground to an impalpable powder. Another method is to dissolve the mercuric iodide in excess of potassium iodide solution and precipitate the double salt by the addition of copper sulphate solution. The silver salt can be prepared in a similar manner by double precipitation. Whichever method is adopted, the product should be well washed to eliminate soluble impurities, as these appear to retard the colour change, as well as to affect its character.

Having prepared the double salts and mixed them in the proper proportion, the means of applying them arises. It has been found convenient to convert them into a varnish-paint or enamel, by incorporating the powder with a colourless varnish medium that will stand moderately high temperatures without softening. A good white shellac spirit varnish such as is used on electrical machinery has been found suitable for most occasions, as this will stand a low stoving temperature, but for more elevated temperatures, a medium such as is used in the high temperature aluminium paints used for steam pipes, etc., and which will resist temperatures up to 200° C. is excellent. About 100 grams of compound to 70 c.c. of medium will be found a mixture of suitable consistency.

A convenient method of applying this heat detector is first to paint a white circle or ring on the bearing or other place which it is desired to keep under observation, using a zinc white paint. This white circle is applied to the journal or housing of the bearing, and the detector paint is applied as a vivid red bull's eye in the middle of this, thus forming a very striking object which is visible from considerable distances. It must of course be applied to the block of metal as near as possible to the point at which the heat is likely to be generated. It is sometimes desirable to apply the paint to the shaft itself, just where it extends beyond the bearing metal, and in this case, a convenient method is to apply a broad band of white paint with a narrower band of the red detector paint in the centre. This red band in the centre of the white one is then easily seen as the shaft rotates. In any case, after the paint is dry, it should be protected with a coat of colourless oilproof varnish, so that the surface may be occasionally wiped free from dust and dirt.

The visibility of the paint against its white background is very high, the bright scarlet colour being visible from long distances without effort, and the change at 60°—70° to black is very easily observed, the visibility of the black on the white ground being very much lower. It is generally easy to arrange matters so that the detector is placed in a position where it is visible almost without conscious effort; and experience has proved that a workman is easily trained to cast his eye occasionally on the detector, while he could not be depended upon to climb up to the spot and feel the bearing on the remote chance of finding it heating up. When the paint changes colour, there is certainly something wrong, but generally speaking, it will be found that the matter is taken in time, and that no damage is done, the bearing simply requiring cleaning and adjustment without serious stoppage and expense

This detector has also been successfully used on a gas engine, one of the main bearings of which was frequently heating up, owing to a slightly distorted shaft, and it was possible to place good big "bull's eyes" upon it, which on many occasions gave warning of impending trouble, enabling the load to be reduced before damage was done. It was also found of service on the water-jackets of large internal combustion engines to give warning of insufficient circulation of cooling water.

Many other instances occur in which this property of the double mercuric iodide compounds may be taken advantage of, for instance, it may be used in the reverse way on air-heating towers and the like. A case in point is that of a producer gas plant where the air supply is saturated with water vapour at about 70°—75° C. If the outside of the tower has a white circle about 3 feet in diameter painted on it, with a centre about 1 foot in diameter of the detector paint, the appearance of a red colour, visible all over the plant, is a sign that the saturation temperature has fallen too low and requires attention. The same applies to feed water heaters for boiler feed water.

Where rather higher temperatures require indication, the silver compound which undergoes transition at about 90°—100 C. may be employed, to draw attention to the fact that the water is boiling away and may need replenishing. The application to vacuum evaporators, exhaust turbines etc., is also indicated.

The writer has had some of these indicators in action for the past ten years and the colour change is just as sharp and distinct now as when originally installed. The varnish medium has in some cases called for renewal, but as no special precautions were, at that time, taken in the selection of the most suitable medium, this result is not unnatural. If a really good medium such as is employed in radiator paints be selected, the varnish should endure under normal circumstances for very many years.

CURRENT ACTIVITIES IN DYE PRODUCTION.

An estimate of the extent to which certain British industries were dependent on the pre-war German monopoly of dyes may be gained from a report recently issued by the Board of Trade, giving statistics of the synthetic colouring matters imported during 1913. Although only 18,000 tons of dyes came into England, valued at £2,000,000, the industries dependent on this importation had a yearly output of over £200,000,000. In 1914 a committee was appointed by the Society of Dyers and Colourists to compile a census of the dyestuffs used in Britain, but owing to various difficulties the returns obtained were very incomplete, and remained so until 1916. The Board of Trade, however, took up the matter, and the abovementioned report is the outcome. The contents of the book consist chiefly of a list of the colours imported, together with the quantities and the makers' names. Each specific variety of dye is given; for instance, there are 155 distinct kinds of methyl violet, and it is pointed out that this multiplicity must cause needless expense in manufacture; accordingly British makers would be well advised to limit the number to two or three varieties, leaving the consumers to alter the shade by admixtures with other dyes.

Although about 10,000 colours are listed, this quantity is really very much greater than the actual number of distinct dyes, owing to the use of multiple names for the same colour. Benzo Sky Blue appears under at least nine different synonyms. Moreover, many commercial dyes are complex mixtures.

In the summary of imports, the cheap direct cotton colours head the list with just under seven million pounds weight. This great vogue is due to ease of application rather than to the permanence of the dye. Chrome and other mordant dyes were imported to the extent of 6,477,065 lb., while the extremely fast but expensive vat dyes total only 588,445 lb. Nearly the whole of the dyes mentioned in the report came from Germany, a small minority coming from Switzerland, and a few from France. The dyes mentioned in Part I. of this report are indexed in Part II. of the same publication.

It is interesting to compare the above report on imported pre-war dyestuffs with the progress made since August 1914 in the manufacture of coal tar colours in England. Some light is thrown on the latter subject by an attractive twenty-three page booklet issued by Messrs. Levinstein, Ltd. This brochure emphasises the importance of dyes for war purposes in the dyeing of military and naval uniforms, and calls attention to the employment of colouring matters in the production of "camouflage," a military use of tinctorial chemistry which was developed extensively in the later phases of the war. An historical summary of "Indigo through the Ages" introduces the subject of British synthetic indigo. This pigment was not manufactured completely in England before the war, but a factory, established at Ellesmere Port by a combination of several German firms, was utilised in the last stage of indigo production from German intermediates, a procedure adopted by these aliens in order to comply with the Patent Act of 1907. The factory was acquired by Messrs. Levinstein, who within three months had placed synthetic indigo successfully on the market. This enterprising firm, which has not limited itself to indigo, now produces several related vat dyes, including thioindigo, Durindone Red B and Durindone Blue 4B. The last of these, which is a dibromindigo, is of special interest, as being an isomeride of the famous Tyrian purple. Carbindole Blue R is a vat dye of the valuable hydrone blue series which is now prepared by Messrs. Levinstein. Other outstanding items in the rapidly increasing lists of this firm's productions are the drugs acriflavine and novocain and the important series of eosin dyes.

The magnitude of the task before the British dye industry will be appreciated by realising that the German capital invested in dyestuff production is £50,000,000, whereas the corresponding British capital is only £5,000,000. Our rejuvenated dye industry will therefore need careful nursing.

That Americans are very much alive to the corresponding facts in their own country is shown by their Dyestuff Tariff Act of September 8, 1916, and the proposed Bill to amend it. This Act, which protected the dye industry in the United States at the time and made home manufacture the criterion of future tariffs, has apparently accomplished its object in encouraging the investment of capital in the United States dye industry, but it now appears that there are several loopholes in the wording of the Act through which foreign competitors might succeed in evading the import taxes and might thus capture the trade. A draft Bill to remedy these defects in the Act has been issued by the United States Tariff Commission.

One possibility of evasion resides in the fact that many dyes could be imported as leuco bases under the title of intermediates, and could then be converted easily and cheaply into finished dyes by simple oxidation in one process. For instance, indigo could be imported in the unfinished form of indoxyl and converted into indigo simply by blowing air through the aqueous solution of the inter-

mediate. The Act could also to some extent be evaded by importing highly concentrated dyes instead of the usual commercial brands produced by diluting with salt, dextrin, &c., or a paste of the dye could be diluted further after importation. In the Act of 1916 certain dyes (anthracene and carbazole) were exempted from the specific 5 cent import duty. In the new Bill it is proposed to include these important vat dyes, as it is just in the manufacture of such colours that the United States is backward. This leeway will be made good now that anthracene, which was not available before the midsummer of 1917, and carbazole are being produced on a commercial scale. Another developing branch of manufacture which it is intended to protect is that of synthetic tannins, obtained by condensing phenol and formaldehyde by the agency of sulphuric acid. These substances, which were discovered about 1912 and are being manufactured in England, seem likely to become of great importance in the future, and may provide an outlet for the large quantities of synthetic phenol which should soon be on the market.

The foregoing summary of recent activities in dye production shows plainly that supremacy in this important branch of chemical industry will, as in the past, be gained by the nation or group of nations in which research is most closely co-ordinated with industrial requirements and developments.*

CHEMICAL INDUSTRY ON TYNESIDE.†

P. PHILLIPS BEDSON.

In taking for a second time the position of chairman, it is natural that my thoughts should turn to a like occasion when I addressed the members of this Section some 32 years ago. I recall that I then spoke of the benefits conferred by research, pursued for the advancement of knowledge for its own sake, upon industry and its contribution to the amenities of life. The past years have afforded innumerable examples, and the war has produced such an awakening to the importance of the spirit of science, that the clamour has penetrated even to the ears of those who had been accustomed only to listen for and attend the behests of the "division bell." As you are aware, research has received State recognition, and there exists a Government Department to organise research and to distribute funds to aid the carrying on of investigations, scientific and industrial. This is certainly all to the good, yet in the administration of the funds there lurks the danger that attention may be focussed on the apparently immediately useful, giving but scant encouragement to those investigations which have in view the object of advancing knowledge. Viewed from the standpoint of utility, what more unpromising subject than the investigation of the chemistry of the rare earths? Yet I was able in my address to this Section in 1886 to point to the promise of a great advance in the gas lighting industry, afforded by the facts which were enshrined in von Welsbach's researches on the rare earths, out of which has grown the gas mantle industry. The dimensions of this industry may be estimated from the fact that the world's consumption of gas mantles in 1912 amounted to about 222 millions, and that in the course of the development of this industry the price of "thoria" has been reduced by one half.

What again could be said at the time of their initiation and progress of the industrial utility of the investigation of the phenomena of dissociation, associated with the name of St. Claire Deville? Apparently of but purely theoretical import, they have led to conclusions of the greatest possible service to industries so diverse as the manufacture of oxygen from the air, the manufacture of iron and steel, and many others. Or again let me quote the words of Dr. Thomas Young, the physicist:—"No discovery however remote in its nature from the subject of daily observation, can with reason be declared wholly inapplicable to the benefit of mankind." What can be conceived as more remote from industry, than the fact that the weight of a litre of atmospheric nitrogen exceeds that of a litre from other sources by 6·7 milligrams? Yet the investigation of this difference has resulted in the discovery in the air of a new class of elements, distinguished by their chemical inactivity. Nay, more, this very inactivity of the chief of these has already, within twenty years of its discovery, found an industrial use in the manufacture of electric lamps.

In addressing a body of industrial chemists, there is no necessity for me to press the point, still I would ask you to impress on others the importance to the well-being of the nation, of having in its midst schools of chemistry, where those who possess the divine afflatus may unreservedly devote themselves to the exercise of their gift, and inoculate others with the desire to extend the bounds of knowledge, so that there may arise in this country an army of workers devoted to the pure science.

Turning next to a contrast of chemical industry on the Tyne and district between now and 1886, I will take first the alkali industry, which, to the ordinary mind, is *the* chemical industry of the Tyne. Whilst from the historical point of view much might be said for this position, still as you know there are few of our industries which cannot be designated chemical, or to the carrying on of which a knowledge of chemistry is not essential.

Already in 1886, the Leblanc process for the manufacture of alkali was throughout the country suffering from competition with the ammonia-soda process; and at that time the number of chemical works was ten, a considerable decline from the position in the early 70's, the steepness of which was moderated by two influences, one being the exploitation of the salt field of South Durham. The knowledge of the existence of this salt deposit was allowed to remain dormant for nearly 30 years. Each of the three most important Tyneside firms, viz., the Newcastle Chemical Co., Messrs. Tennant & Co. of Hebburn, and the Jarrow Chemical Co., took part in the enterprise, which resulted in making these firms independent of the supplies of salt from Cheshire. Another factor which has contributed to lengthening the lease of life of the Leblanc process on Tyneside was the installation at Gateshead of the "Chance" process for the recovery of sulphur. In 1890 was founded the United Alkali Co., upon which many and drastic changes followed, the sum total of these changes resulting in leaving practically two alkali works, proper, viz., Allhusen's at Gateshead and Tennant's at Hebburn. Under the *régime* of the United Alkali Co. these works have been carried on in close co-operation, producing a variety of products nearly related to the main articles of manufacture, such as hyposulphite, sulphide, sulphite, and silicate of sodium. These years have also seen the re-introduction to Tyneside of the Deacon process for the production of chlorine, which it would appear is capable of competing favourably with the Weldon process. We may note, by the way, that the war has brought again into prominence the use of

* References:—1. "Statistics of the Synthetic Dyestuffs imported into the United Kingdom during the year 1913." Board of Trade Report. 1918.

2. "Four Years' Work." An account of the progress of the Coal Tar Colour Industry in England during the war. Levinstein, Ltd.

3. "Dyes and Other Coal Tar Chemicals." Report to Congress, United States Tariff Commission. 1918.

† From the Chairman's address to the Newcastle Section on October 30, 1918.

bleaching powder as an antiseptic, *e.g.*, its employment as "Eusol" as a source of hypochlorous acid in the treatment of wounds. In this and in other ways have the antiseptic properties of chlorine and its compounds been rehabilitated. Although the operations of the Leblanc process have attained a completeness in the conversion of each of the components of salt into merchantable materials without the material waste which was associated with it in 1886, we are told that we are witnessing its death throes. Were we permitted at this stage to draw aside the veil, we should find evidence of the attempt to retain the alkali industry on Tyneside by the use of electricity in the first stages of the production of alkali and bleaching powder from salt. Whether the Tyne will retain the position which it has held since 1796, as a seat of the manufacture of alkali, with its disability as regards the salt, in competition with factories having an easy command of brine, remains to be seen. In other words, will the proximity of salt or of coal be the determining factor?

In passing, we may recall the fact that the manufacture of alkali in Great Britain had its origin at Walker, where Lord Dundonald and Mr. Losh commenced operations for the manufacture of soda from the brine spring at Walker Colliery.

Amongst the allied industries, which during the past 30 years have found a *locus* on the Tyne, is the manufacture of barium peroxide, the chief product of the Hedworth Barium Co., the introduction of which to the Tyne was largely due to the pioneer work of Mr. W. Rowell. The present processes of this interesting manufacture are very largely based upon the original investigations of Dr. Charles Rollin.

The cheapening of the cost of the manufacture of metallic sodium by the decomposition of caustic soda led to a revival of interest in the manufacture of aluminium, and in the '80's an attempt was made to establish this industry on Tyneside at Wallsend. Although short-lived, it exhibited many points of special interest, for Netto's process for the manufacture of sodium embodied a material simplification of Castner's method, and by using the mineral cryolite, as the source of aluminium, a very material simplification was possible, as compared with the Wöhler-Deville process, which involved the manufacture from a pure alumina of the double chloride of sodium and aluminium as a preliminary stage. Despite these advantages the operations were short-lived owing to the discovery of the more direct electrolytic process. We have not, however, completely lost touch with the manufacture of aluminium, for at Hebburn the extraction of alumina from bauxite by Baeyer's method is in operation, a process which affords an excellent illustration of the utility of a reversible reaction and an exemplification of the law of mass action.

The most prominent change which has taken place in the years under review has been the rise and development of the production of electricity, both by private and public enterprise. In this field Newcastle occupies the prominent position of a pioneer, as is befitting, when we recall the names of Swan, Parsons, and others who are identified by their achievements with the use and industrial production of electricity. We have seen the gradually increasing use of the facilities offered by the existence of these enterprises, and how they have contributed not alone to the amenities of life, but to growth and development in industries, chiefly as a mechanical aid. The employment of the thermal effects produced by electricity are seen in the manufacture of vitreosil, of which Dr. Bottomley has given the Section an account, and exhibited chemical appliances made by his ingenious devices (this J., 1917, 577).

My predecessor in this chair, in his opening address, gave us some remarkably interesting examples of the use of the chemical effects produced by the aid of the electric furnace. All who were present on that occasion will recall with interest not only the products of the electric furnace, but also the account which Mr. Peile gave of how he had employed waste products of the coke oven to produce the electricity required. It will always appeal to me as an epic of the utilisation of waste. This naturally directs our thoughts to the changes which the last few years of the period I am contemplating has witnessed in the practice of coking,—changes which are responsible for the rise of a new chemical industry, pregnant with the possibility of further extension, and which owe so much of their development to the inspiration derived from the purely speculative conceptions enshrined in Kekulé's theory of the constitution of benzene. Time forbids more than a brief reference to the complete scientific utilisation of coal, but I may be permitted to express the regret that its advent into industrial practice has been so slow and long delayed. I have a vivid recollection that, about 1883, considerable interest was aroused locally in the attempt to adapt the recovery of by-products to the coking of coal in beehive coke ovens. But such interest was quite evanescent, and for some years methods of coking with recovery of by-products received but scant attention, for the reason advanced by the old coal philosopher, Stauf, "the enterprise did not pay." I do not think that we can accept Goethe's explanation of the non-success of Stauf's enterprise, who said that the object was not only to desulphurise the coal for the use in iron works, "but at the same time they wished to turn the oil and resin to account; nay, they would not lose the soot, and thus all failed together, on account of the many ends in view." Still Goethe's view influenced, sub-consciously, the views of many for upwards of a century, and with other prejudices retarded the use of those processes for the complete utilisation of coal, both as a source of material and of energy, which happily we see in operation to-day.

In concluding this sketchy review of the progress of chemical industry on Tyneside during the past 30 years, I should not omit to mention the establishment in our locality of the manufacture of compressed gases, under the auspices of the British Oxygen Co., and also at the various rescue stations at which the liquefaction of air and the separation of its constituents are practised. Further one must chronicle the fact that for some few years sodium has been manufactured on Tyneside by the Castner-Kellner Co., and that latterly attempts have been made to work a process for the manufacture of zinc, an enterprise which does not appear to have been altogether successful.

NEWS FROM THE SECTIONS.

BRISTOL.

An ordinary meeting of the Bristol and South Wales Section was held at Bristol University on February 20, when Mr. T. H. Butler presided and Dr. H. W. Bywaters gave a lecture on "Cocoa and Chocolate." Cocoa was known in Mexico some 3000—4000 years ago, and was introduced into Spain about 1520. So well did the Spaniards guard their secret that 100 years elapsed before the knowledge of it was introduced into England. It came to Bristol in the 18th century. Attention was drawn to the cultivation on the Gold Coast, which has been greatly developed in recent years, three-quarters of the cocoa used in this country emanating from that source. The lecturer also described the cocoa tree, the nature of the bean, and the various processes of manufacture.

LONDON.

At the meeting held on March 3, under the chairmanship of Dr. Charles A. Keane, the adjourned discussion on "Refractometry and its Applications in Technical Analysis" was opened by Mr. A. R. Ling. After referring to the importance of minute and rapid physical measurements in modern scientific control, the speaker suggested that discussions similar to the present might profitably be started on other instruments such as the microscope and the polarimeter. The refractometer is probably the most rapid in its application of all physical instruments, and in the sugar industry has been specially employed to determine the total solids in commercial sugars, worts, etc. As mineral and nitrogenous matters raise the specific gravity of solutions more than sugar, the results by the refractometer are more accurate than those by the older specific gravity method. In taking the refractive index of such solutions, however, difficulty is often experienced owing to their dark colour, and the obvious method of reducing this by dilution with water is open to the objection that a dense solution, like molasses, when diluted undergoes a marked contraction. This has been overcome by diluting with a solution of pure sugar instead of water. Mr. Ling also referred to Tornöe's refractometer, designed to extend the use of this instrument to the determination of the "original gravity" of beers. He also suggested that English makers would do well to consider the possibility of putting on the market an interference refractometer working on the lines of that used by Lord Rayleigh. Dr. Lowry emphasised the importance of temperature control and the wave-length of the light employed in refractometry. The temperature jacket in the Pulfrich instrument, for example, is very imperfect and he had found that a difference of 10° C. made a difference of 1° in the reading. In place of the ordinary sodium light, he considers that the green mercury line with a wave-length of 5461 would be preferable; a cadmium lamp would of course be good, but at present requires so much skill and experience in its use. Other applications of the refractometer were discussed by various speakers, for instance its use in following the hydrogenation of oils, and the examination of "blown oils" in which the iodine number decreases as the refractive index increases. Again, in the examination of protein substances the amount of protein is a linear function of the refractive index and is independent of electrolytes present. Mr. E. T. Brewis called attention to the value of refractometry in detecting adulteration in essential oils, and expressed the opinion that a temperature of 20° C. would be a convenient standard to adopt. This question of the temperature at which readings should be taken was followed up by Mr. S. G. Thomas, who suggested that a committee might be formed to investigate the general question of standardising the conditions under which physical measurements should be determined. Prof. J. C. Philip drew attention to the fact that the refractive index of the prism must be borne in mind. Mr. Browning pointed out that essential oils have to be examined in tropical countries where a temperature of 20° C. would not be easy to adopt. He also referred to one form of refractometer to which very little attention had been given in the discussion, namely, the Oleo-refractometer, one useful feature of which is that the readings of vegetable oils are to the right of the scale and those of animal oils to the left.

The meeting was favoured with the presence of Mr. S. R. Church, a member of the Committee of the New York Section, who in the course of an interesting speech expressed the feeling of respect and appreciation with which the Society is held in the United States.

Mr. F. Esling described some work on "The Setting Time of Portland Cement," which showed that the setting time of a medium cement is influenced to a considerable extent by the nature of the solids contained dissolved in the water.

Mr. Yeoman described very briefly the work he had carried out in conjunction with Dr. G. H. J. Colman on the determination of benzol, toluene, etc., in coal tar. The paper will appear shortly in the Transactions.

NOTTINGHAM.

The members of this Section assembled on February 26 to nominate officers for election and to hear two papers. The first, by Messrs. J. M. Wilkie and J. H. Rice, described a simple and efficient electrolytic Gutzeit apparatus for the determination of arsenic. The parchment diaphragm used to separate kathode and anode, as *e.g.* in the apparatus of Sand and Blackford, has a number of disadvantages, including liability to rupture, so for this the authors substitute a porous pot surrounded by a cylindrical lead anode cut from a piece of two-inch lead pipe. The porous pot is closed gas-tight by a rubber bung through which are inserted the kathode, a rod of lead with enlarged end, and a glass tube of 5 mm. diameter packed with lead acetate wool and fitted at the upper end with the spring-clip device holding a piece of mercuric chloride paper (see this J., 1916, 672). Electrical connexions are made by lead studs fitting into holes in the electrode lugs, thus avoiding all danger of contamination with copper and brass. The electrolyte is 10 per cent. sulphuric acid and the current 4 ampères at 5 to 6 volts. With solutions containing arsenic as arsenite, and free from organic matter, the production of a quantitative stain is complete in about ten minutes. With arsenate the deposition was found to be very incomplete in the same time. Previous and possible methods for the conversion of arsenic present in organic matter into a form suitable for estimation were tested and criticised. In the method finally adopted, the sample mixed with magnesia is ignited in a vitreous silica beaker (fusible alkali being carefully excluded), the ash is dissolved in sulphuric and hydrochloric acids, reduced by the addition of sodium metabisulphite and the excess of sulphur dioxide boiled off. No arsenic is lost if the amount of hydrochloric acid is kept below a certain limit. The solution, thus prepared, introduced into the kathode compartment of the above cell, also gives quantitative results. The Chairman, Mr. F. H. Carr, then called upon Major S. R. Trotman, recently returned from a long absence on military duties, to open the discussion. Major Trotman spoke of the difficulties and uncertainties of the Marsh test, alluded to the necessity of testing parchment membranes for arsenic, and expressed his intention of adopting the authors' method, which possessed the great merit of not requiring the constant attention of a skilled manipulator.

The second paper was a preliminary note on a new method for the determination of sodium thiosulphate and compounds of other sulphur acids by Messrs. J. M. Wilkie, E. H. England and T. W. Thornhill. The analytical determination of these acids has chiefly attracted interest in connexion with the Feld process of purifying coal gas, and the analysis of the lime sulphur washes used in agriculture: it was originally applied by Wilkie to the determination of sulphur and sulphides in a paper read before this Section in 1916. The method depends on the oxidation of sulphur by means of bromine, the acidimetric determination of the sulphuric and hydrobromic acids, and the

iodine absorbed by the original sulphur compounds. These data also give information as to the proportions of two or even more sulphur compounds present in solution together. Different compounds will show different values of the characteristic ratio, total acidity developed to iodine absorbed. The experimentally determined ratios agree very closely with the calculated values.

MEETINGS OF OTHER SOCIETIES.

THE CERAMIC SOCIETY.

In a paper read on February 13 at Stoke-on-Trent, on "Recent Work on the Bone China Body," Dr. J. W. Mellor described and offered explanations of the phenomena observed on firing the bone china body. This material, which is made from quartz, felspar, clay (introduced in the form of "Cornish stone"), together with bone-ash and china clay, undergoes very great contraction on firing, but above the finishing temperature there is a marked tendency towards expansion. This peculiar result is due to the development of small cavities in the interior of the over-fired ware, evidently caused by the development of gas. The gas bubbles developed in the body of bone china during the firing of the oven mark the start of the same reaction as that which takes place in the manufacture of phosphorus from charcoal, bone-ash, and quartz, the reducing atmosphere in the former taking the place of the charcoal in the latter. The iron content (1·0—1·5 per cent.) of the bone china body is one of the first constituents to be attacked by the liberated phosphorus to form iron phosphate. Indications of the formation of greenish blue, blue, and brown colours, similar to those shown by the mineral vivianite, are to be seen in the bone china body by holding it in front of a strong light, and these changes are attributed to the presence of iron phosphate. Blue china can be made quite readily by enclosing some charcoal or organic matter in the saggar with the china while it is being fired, or by using bone containing a little carbonaceous matter. This explanation does not altogether agree with the facts that the bone used for the very best china is sometimes rather above the average in carbon, and that blue china can easily be obtained with bone-ash practically free from carbon and fired throughout under highly oxidising conditions. Much seems to depend on the state of the carbon, one form of which burns out readily and another does not. The particular form present is believed by the author to depend upon the method of calcining the bone, the slow-burning harmful form being produced when the bone is heated rapidly to a high temperature.

The effect of composition on colour of china was shown by means of special triangular diagrams, which explained some of the anomalies previously alluded to. There is a much greater margin of safety in varying the proportion of bone-ash than that of either stone or clay. The tendency to produce the blue or brown china increases as the proportion of stone diminishes and as the proportion of clay increases; in other words a high proportion of alkalis hinders the formation of iron phosphate. Slight changes in the character of the stone or clay used may give to an otherwise perfect body a tendency to form blue china or to blister, etc. Similar considerations apply to subsequent firings to fix the glaze, or to over-glaze decoration. The change from white to blue and brown china may even result from prolonged exposure to the action of ordinary air, and such discoloration sometimes occurs by exposure of china in a shop window.

From the fact that the phosphate decomposes as the proportion of stone increases, it appears as if the stone favours the decomposition of the bone-ash. The author believes there are two distinct actions. The alkalis first start to vitrify the body, but at the higher temperature the free silica (quartz) in stone acts as an acid and decomposes the phosphate.

SOCIETY OF GLASS TECHNOLOGY.

The February meeting was held at the University, Sheffield, on the 19th, Mr. J. Connolly occupying the chair.

The first paper, entitled "The Properties of the Lime Soda Glasses, 2.—The Resistance to Water and other Reagents," by J. D. Cauwood, Constance Muirhead, and W. E. S. Turner, was read by the last-named. Several glasses had been melted on a small scale, and the lime content had been increased by definite amounts. The resistance of each glass to water, caustic soda solution, sodium carbonate solution, and hydrochloric acid, was tested, and in every case it was found that increasing the lime content brought about increasing resistance. In the second paper, "The Properties of the Lime Soda Glasses, 3.—The Thermal Expansions," by S. English and W. E. S. Turner, the same series of glasses mentioned above (*i.e.* with lime content increasing up to 10 per cent.) was tested in regard to thermal expansion, and it was proved that the expansion decreased as the lime content increased.

Prof. P. H. Boswell then addressed the Society on "Impressions of the Glass Industry of the United States gathered on a Recent Visit." Dealing with the supplies of raw materials in the States, Prof. Boswell stated that six sands were in general use, one of them—a beautiful sand from Rockwood, Detroit—was used exclusively for optical glass. The American "sands" are not found as such, but in the form of fairly soft sandstone. This is blasted, and washed by water under pressure into the bottom of the pit, whence it is dredged up to the top of the pit. It is emptied into concrete bins, and works down through steam pipes until it emerges as dry, clean-running sand. The diameter of the steam pipes constituting the top layer is 3 in., that of the bottom pipes 1 in., and there is about 1 in. clearance between the pipes. The sand is then loaded into covered wagons, each of which contain 50 to 80 tons of sand. The cost of labour in the sand pits is greater than that in this country, the workmen being paid about 1*s.* 6*d.* per hour, and yet the price of sand is less than that of English sand. The washed, dried sand, which on the whole was superior to English sand, varied in price from 5*s.* to 9*s.* per ton at the pits. The cost of transportation also was less than in this country, the highest rate being about 5*s.* per ton. The fact that American sandstone firms can put their sand on the market so cheaply is due to the immense output. One firm alone quarries nearly half a million tons per year. It is calculated that the overhead charges for 200,000 tons are not much greater than for 50,000 tons. The quarrymen work about 9 hours per day, but contract to keep the bins full, and thus work considerable overtime to make up for loss of output due to bad weather. Prof. Boswell afterwards dealt briefly with American supplies of potash and felspar, and then passed on to the question of refractories. He showed a specimen of a glasshouse pot, developed by Dr. Bleininger, which after the melt had been performed was perfectly white in colour and very close in texture. In making their pots the Americans were substituting kaolin from Georgia for Cornish kaolin, and were using ball clays from Tennessee and Kentucky in place of those from Devon and Cornwall. Considerable advances have been made in slip casting pots. One firm, which formerly built pots in the English fashion, now uses

raw fireclay and grog. Tank blocks were also being made very successfully, and considerable research has been carried out on "humidity drying." Silica bricks are manufactured on a considerable scale in the States, the methods employed being much the same as in the United Kingdom, except that the bricks are burnt for a much longer period. Dr. Boswell then dealt briefly with the various types of glass manufactured in the States, and laid special emphasis upon the number of labour saving devices in use, which resulted in a huge output.

SOCIETY OF PUBLIC ANALYSTS.

At the meeting held on March 5, Dr. S. Rideal presiding, the following papers were presented :—(1) "Approximate Method of Analysis of Sausages and Meat Pastes," by G. Stubbs and A. More; (2) "Analysis of Sausages, Meat Pastes and Army Rations," by A. W. Stokes; and (3) "Method for the Determination of Small Quantities of Acetone, Alcohol and Benzene in the Air," by Major S. Elliott and Capt. J. Dalton.

(1) The determination of moisture, fat, proteins and ash is carried out in the usual manner, and the proportion of carbohydrates taken by difference. The estimation of lean meat is based on the absence of carbohydrates in meat and the amount of proteins in the cereal products used as fillers.

(2) The Food Control authorities limited the percentage of meat which might be contained in sausages to be sold at a given price, but did not limit the quantities of bread, water and fat. The desirability of limiting the quantities of water, bread and fat was shown by a particular sample which contained about equal parts of added water, bread, fat and meat. Since meat contains 70 per cent. of water and bread 40 per cent., no added water should be allowed. In the United States the use of bread in sausages is prohibited and, as the bread is often soaked in water before use thereby increasing the percentage in the finished product, the author pointed out that this prohibition might with advantage be enforced in England.

(3) A measured quantity of the air is drawn through suitable apparatus, the vapours being absorbed simultaneously as follows: The acetone in alkaline iodine solution and the excess of iodine titrated with thiosulphate. The alcohol in dilute chromic acid, and after oxidation to acetic acid, the excess of chromic acid is titrated with iodine. The benzene in a mixture of concentrated sulphuric acid and fuming nitric acid, converted into dinitrobenzene, and after extraction with ether, reduced by a known excess of stannous chloride and the excess of the last reagent titrated with iodine.

THE INSTITUTE OF CHEMISTRY.

At the 41st annual general meeting, held on March 3, Sir Herbert Jackson, the President, referred to the work of the Institute during the war. The record afforded an example of the value to the country of organised professional bodies in times of crisis. The Report contained a concise statement indicating the various directions in which chemists had rendered good service both with the Forces and in industries connected with the war. The Institute is now co-operating with the Appointments Department of the Ministry of Labour in the resettlement in civil life of those who have been so engaged, and it is hoped that with the return of more normal conditions chemists will be utilised to the fullest benefit of the industries of the country. The President, in referring to the losses sustained by the profession, mentioned especially Lieut.-Colonel E. F. Harrison, who will always be remembered for his exceptional work in the provision of means of defence against poisonous gas attacks, to which work he undoubtedly sacrificed his life.

The Institute has before it a period of reconstruction and will endeavour to bring together in one body the trained and competent chemists both for their own benefit and for that of the community. The Regulations had been modified on such a broad basis that it was hoped all qualified chemists would be able to take part in promoting the welfare of their profession. The Council hoped in the near future to arrange a conference to review the subject of the training of chemists. Local Sections are being formed in various parts of the country and the method of the election of the Council will be amended to ensure that its constitution is properly representative of all districts and all branches of professional work.

Sir Herbert Jackson was re-elected President: Prof. G. T. Morgan and Mr. G. Stubbs were elected Vice-Presidents: and the following were elected new Members of Council: Prof. A. Findlay, Drs. A. C. Cumming and E. W. Smith, and Messrs. W. Bacon, F. H. Carr, G. W. Gray, F. W. Harbord, A. More and B. D. Porritt.

PERSONALIA.

Lord Moulton has accepted the position of chairman of the British Dyestuffs Corporation, Ltd.

Sir J. J. Thomson has resigned his post of Cavendish Professor of Physics at Cambridge University after 35 years' service.

Mr. J. Kewley has been appointed chief chemist to the Asiatic Petroleum Company, Ltd.

Among the fifteen candidates selected by the Council of the Royal Society to be recommended for election to the Society are:—Dr. G. Barger, Dr. J. W. Evans, Prof. B. D. Steele, Mr. G. I. Taylor and Prof. T. B. Wood.

The death is announced of Prof. G. Carey Foster, professor of physics at University College, London, from 1865 to 1898, and first president of the Physical Society of London.

Sir Oliver Lodge, Principal of the University of Birmingham, announced at a recent meeting of the Governors that it was his intention to retire from that position within the next few months.

Sir Lazarus Fletcher has retired from his post of Director of the Natural History Museum, having reached the usual age limit. Prior to his appointment in 1909, he had been Keeper of Minerals for 29 years.

Dr. A. Rée, representing the Association of British Chemical Manufacturers, is one of the delegates of the Federation of British Industries now on a visit to Paris to confer, under governmental auspices, with representatives of France concerning industrial reconstruction in that country, and the promotion of co-operation between British and French manufacturers.

The Edinburgh University Court has appointed Dr. G. Barger to the chair of chemistry in relation to medicine. Dr. Barger was formerly professor of chemistry at the Royal Holloway College, University of London, and prior to that head of the chemical department at the Goldsmiths' College, New Cross, S.E.; he has lately been serving as research chemist to the Medical Research Committee, National Health Insurance.

NEWS AND NOTES.

CANADA.

New Chemical Industries.—Brunner, Mond (Canada), Ltd., has now completed its plant for the production of soda ash at Amherstburg, Ontario. This firm will be the first to produce soda ash in the Dominions. The normal imports amount to 50,000 tons, and many industries were greatly handicapped for lack of supplies during the war period. The company is self-containing, generating its own power, and obtaining salt and limestone practically on its own property.

The Chemical Commonwealth Corporation of Walkerville, Ont., is now manufacturing benzoic acid, benzoate of soda, benzaldehyde and coumarin, and will probably produce vanillin in the near future. It is a large undertaking and is producing for export trade to all parts of the British Empire.

Canadian Water Power.—A very recent census gives the developed water power of the Dominion as 2,305,310 horse power, of which 1,727,471 h.p. is generated at central electric stations. About 450,000 h.p. goes to the pulp and paper companies. Norway and Sweden are the only countries where the *per capita* utilisation of water power exceeds that of Canada. All information regarding Canadian water power developments may be obtained from the Water Power Branch of the Dominion Government, Ottawa.

Nickel Export in 1918.—According to figures supplied by the Dominion Bureau of Statistics, the value of the nickel exported from Canada increased from \$8,631,851 in 1916 to \$10,707,743 in 1918.

Gold Refining.—Since the outbreak of war gold and bullion to the value of \$1,300,000,000 have been received at Ottawa by the Dominion Department of Finance, acting as trustee for the British Government and the Bank of England. The heavy demand on the gold refinery at the Mint has necessitated the construction of a second plant with a monthly output of 1,000,000 oz. of fine gold. As a result of this extension the Canadian Mint has now the largest capacity of any gold refinery in the world.

Steel Industry in British Columbia.—The British Columbia Advisory Committee for Scientific and Industrial Research has reported to the Research Council at Ottawa the preliminary results of an investigation into the possibilities of developing an iron and steel industry on the Pacific coast, the conclusion reached being that, while there is room for one large plant, provided it is assured of the whole Pacific coast market, there is not a sufficient quantity of iron ore in prospect to warrant the establishment of more than one. (See also this J., 1919, 63 R.)

Canadian Chemists.—It is expected that the Second Annual Convention of Canadian chemists will be held in May at Montreal in connexion with the annual meeting of the Society of Chemical Industry. A committee has prepared plans for the organisation of Canadian chemists and will present them to the convention. There is a feeling that closer organisation among chemists is necessary, and it is quite probable that a successful effort will be made to unite the various chemical organisations at present operating throughout the Dominion. This has been the best season ever experienced by the Society of Chemical Industry in Canada. Business men have joined with chemists in discussing industrial affairs, and the Honorary Advisory Council for Scientific and Industrial Research has succeeded in stimulating a general interest in science and chemistry. A further step by the Research Council towards facilitating the application of science to industry, has been the appointment of a committee to devise ways and means of aiding scientific journals in Canada, and of securing the publication and circulation of scientific papers.

Constructional Work of the Canadian Steel Corporation.—Constructional work on a very large scale has been carried out by this company even during the period of the war. A complete steel plant is being erected at Ojibway, Ont. Docks, coke ovens, blast furnaces, complete milling machinery and a new town based on a population of 20,000 are items on the programme of construction. The available steel business in Canada is shown by the imports for 1917. During that year Canada imported United States steel to the value of \$119,754,365, which was about 95 per cent. of the total imported. There is ample room for the operations of such a company.

BRITISH INDIA.

Olibanum.—The Indian Forest Research Institute has investigated the possibility of preparing turpentine, resin and gum from *Boswellia serrata*, a tree which grows abundantly in the Khandesh district and which is widely distributed throughout the whole country. The yield of gum-oleo-resin obtained from the tree varies with its age and with the methods of tapping employed. Trees having a girth of over 30 in. yield 1½—2¼ lb. during the season (December—June), and the cost of production is estimated to be 1*d*.—1½*d*. per lb., but much less than this in certain districts. An average sample of the gum yields 8—9% oil, 55—57% resin, and 20—23% gum. A technical separation of the three constituents was undertaken by the Department, which found that the products obtained could be marketed successfully, and that their manufacture might initiate an important industry. The oil consists mainly of *d*-pinene mixed with β-pinene; it closely resembles the superior American or French turpentine, and could be successfully employed as a substitute for oil of turpentine. It has a rapid drying power and will probably be found to compete successfully with the American oil. It gives a slightly dull varnish, but is superior to the American oils in accelerating drying. The resin could be used as a substitute for colophany and is well suited for varnishes. The gum is a little inferior to the ordinary gums but extensive trials in the textile mills have shown that it is suitable for use in sizing and finishing. In the process of separation, extraction of the resin with petroleum spirit was found to be best, although the use of trichlorethylene is also recommended. Distillation with steam followed by extraction gave better results than the reverse process. The separated products were submitted to manufacturers in Great Britain and India who pronounced very favourably upon them.

UNITED STATES.

Rotary Limekilns at Muscle Shoals.—At the Government Nitrate Plant at Muscle Shoals, Alabama (designed and constructed to produce 110,000 tons per annum of ammonium nitrate), the seven limekilns employed are of the continuous rotary type, and made of steel lined with fire brick. They measure 125 ft. long by 8 ft. diameter, are nearly horizontal, the pitch being 1 in 25, and are rotated at the rate of ½ revolution per minute by means of a bevelled gear. The limestone is fed in at the upper end, and at the lower end the kilns are fired with powdered coal by an air blast. The temperature attained is 760°—1095° C., and the conversion is complete in 3—4 hours. The capacity of each kiln is about 200 tons per day of raw lime-

stone; when the plant is in full working order the combined capacity of the seven kilns will be 1400—1600 tons.

Potash from Alsace.—The War Trade Board announces that it has received official information from the French High Commission in the United States to the effect that for the next few months practically the entire potash output of the Alsatian mines will be urgently required for agricultural purposes in France. It is the view of the War Trade Board, based upon this information, that even under the most favourable circumstances, no potash from Alsace could be available in the United States for agricultural uses before June, 1919, and that therefore it will be necessary for the United States to rely entirely upon its domestic production for the coming spring season.

GENERAL.

British Scientific Products Exhibition, 1919.—The King has graciously consented to act as Patron of the British Scientific Products Exhibition, 1919, which will be held at The Central Hall, Westminster, during the month of July. The President of the Exhibition is the Marquess of Crewe and Prof. R. A. Gregory is Chairman of the Organising Committee. The British Science Guild has been encouraged to organise this exhibition by the success which attended those held in London and Manchester last year. Now that many inventions can be shown which could not be put before the public during the war, there is every prospect that this year's exhibition will be even more successful than its predecessors. The objects of the exhibition will be to illustrate recent progress in British science and invention and to help the establishment and development of new British industries. Such an exhibition will enable new appliances and devices to be displayed before a large public and will provide manufacturers with an opportunity of examining inventions likely to be of service to them, thus serving as a kind of clearing house for inventors and manufacturers, as well as illustrating developments in science and industry. The exhibition will include sections dealing with chemistry, metallurgy, physics, agriculture and foods, mechanical and electrical engineering, education, paper, illustration and typography, medicine and surgery, fuels, aircraft and textiles. Firms desirous of exhibiting are invited to communicate with the Organising Secretary, Mr. F. S. Spiers, 82, Victoria Street, London, S.W. 1.

Industrial Research.—The Department of Scientific and Industrial Research has issued a revised description of its scheme for encouraging such research. The document lays stress on the policy of the Department to secure the utmost possible autonomy to the industries which form research associations, and includes the following paragraph on "ownership of the results of investigations":—"The whole of the results of researches conducted by any research association will belong to the association itself, which will hold them in trust for the benefit of its members. The Government is, however, specially bound to safeguard the national interests where new discoveries are made with the assistance of Parliamentary funds, and accordingly, besides the powers it already possesses under the Patents and Designs Act, 1907, it will keep in its own hands two additional powers, which may be said to limit the absolute ownership otherwise reserved to the association—the right of veto in case any proposal is made by a research association to communicate any results of research to a foreign person or to a foreign corporation, and the right, after consultation with the association concerned, of communicating the results of discoveries to other industries for their use on suitable terms. The Department will not, however, make any results obtained by a research association available to firms or individuals who are eligible for membership of that association but have not joined it."

National Benzol Association.—This new association was officially inaugurated at a luncheon held in London on February 26. Mr. D. Milne Watson, who presided, announced that the Association will undertake the distribution of benzol independently of the organisation administered by the petrol companies. The total petrol requirements of England, Scotland and Wales are estimated at 200 million gallons per annum; the output of benzol is about 32 million gallons, but it is thought that this total might be increased to 40 millions if the gas companies were given the necessary powers. The Government does not propose to put the Excise tax on benzol.

The objects of the Association include the marketing of a standardised motor spirit, and the stabilising of market conditions so as to encourage the production of benzol at coke-ovens, gas works and tar distilleries. The coke-ovens produce about two-thirds of the present output of benzol and as they are mostly concentrated in the colliery districts, the question of transport and distribution presents difficulties. This consideration also applies to the benzol produced at gas works, and in this case the question is further complicated by the fact that some 90 per cent. of the gas works produce the material in the crude form, which has then to be sent to the comparatively few centres where rectification is carried out. The increased charges due to handling and the special railway rates could be obviated by the erection of rectifying plant at all the works, and a simple installation designed for treating 50 gallons per day is already on the market.

Scientific Management in Industry.—An outstanding feature of the Industrial Conference held under Government auspices on February 27 is the demand of labour for shorter hours and higher wages. Lord Leverhulme and other broad-minded employers believe that this can be done without lessening output. Appeals are made to the working man to abandon the "ca' canny" attitude and other means of restricting output, and it is pointed out that the average output per man in America is three times that of a man in England working under similar conditions. This is one side of the question; the other is the effect on efficiency of scientific management. America and other countries have led the way in this respect and the astonishing results obtained by English firms who have adopted these methods should be more widely known. It is a mistake to suppose that it is applicable only to engineering trades; it would be difficult to find any industry the efficiency of which would not be improved by adopting scientific management. The Industrial Reconstruction Council, 2 and 4, Tudor Street, has taken up the matter, and at a public meeting held on February 28, elected a sub-committee to arrange a series of fortnightly conferences which would deal with this subject in all its bearings. Further particulars may be obtained from the Organising Secretary, I.R.C., 2 and 4, Tudor Street, E.C. 4.

Coal in Ireland.—The Government has granted the sum of £15,000 towards the cost of experimental borings in the vicinity of Lough Neagh (Co. Tyrone), under which coal is supposed to lie. The experimental borings are being carried out under the advice of experts from the English coalfields, and are being supervised by Sir Lionel Phillips.—*(Iron and Coal Tr. Rev., Feb. 21, 1919.)*

Waste in Coal Mining in Germany.—It is estimated that of the 190 million tons of coal mined in Germany in 1913, 140 million tons passed through the classifying plant and sustained a loss of 8 per cent. in that treatment. In addition, the getting of the coal involved the waste of 14 million tons, 10½ million tons was left behind in the form of unworkable seams, and 8½ million tons as safety pillars. The total of these losses therefore amounted to nearly 24 per cent. of the production. The remedies suggested include less exacting requirements of consumers in respect of ash-content and size, and the gasification of inferior coal at or near the pit's mouth for generating power, light and heat for local consumption.—(*Technik u. Wirtschaft, Dec.*, 1918.)

Use of Pulverised Coal in Blast-furnaces.—Determined and organised efforts are about to be made to introduce the practice of burning pulverised coal in blast-furnaces. A company formed in New York to carry this intention into effect has acquired the necessary patents, and has made arrangements for the use of the same at the blast-furnace plant of the Tennessee Copper Co., and at the smelting works of the International Nickel Co. of Canada. Already a large amount of experimental and development work has been done, with encouraging results.—(*Eng. and Min. J., Dec.* 28, 1918.)

Coal Supply in Switzerland.—In consequence of lack of transport and the occupation of the Saar basin, Germany has had to cease exporting coal to Switzerland. The latter country is now negotiating for supplies with France; meanwhile 1200 tons of coal from the Saar collieries is being delivered at a lower price than that formerly paid to Germany.—(*Z. angew. Chem., Jan.* 24, 1919.)

Aluminium from Labradorite.—A Norwegian company, styled the "A.-S. Labrador," was formed in November last with a capital of 2 million kroner for the purpose of producing aluminium oxide and nitrolim by the treatment of labradorite with nitric acid. This mineral occurs abundantly in Norway, in many places in close proximity to undeveloped water power, and hopes are entertained that Norway will become an important producer of aluminium.—(*Farmand, Dec.* 21, 1918.)

Mineral Wealth of Morocco.—The potentialities of Morocco in regard to the supply of raw materials for the chemical and related industries are still comparatively unknown; nevertheless some information is available concerning deposits of manganese ore, iron ores, petroleum and bituminous shale. During the war the manganese deposits have played an important part in the French metallurgical industry, which requires some 10,000 metric tons of ore per annum. France is practically depleted of her native ores; supplies from the Caucasus are shut off, the United States practically monopolises the Brazilian supply, and India is too far off. The phosphate deposits are capable of great development. At the present time the boundaries of the phosphate region are being determined prior to the construction of a railway to connect them with the chief agricultural districts. Indications of petroleum are plentiful in North Morocco, notably in Gharb, on the shores of the Sebu and Uergha, in the valley of the Innau and in the Tasa district. Bituminous shale is found at various places in Gharb, near Meknes, Fez and Tasa. Other mineral deposits include salt, gypsum and slate.—(*Le Matin, Dec.* 5, 1918.)

Electrolytic Iron.—In the process of manufacture, electrolytic iron occludes hydrogen, which renders it hard and tends to make it brittle. The occluded gas is easily removed in the annealing process, the whole of it being expelled at 1000° C. The metal can then be cut with a knife, and is superior to the best Swedish iron. The practical difficulties involved in annealing large masses are being overcome.—(*Giesserei-Z., Nov.* 1, 1919.)

Iron Ore in China.—Although the Shansi iron industry is claimed to be the oldest in the world, the deposits of iron throughout China have, in general, been very little developed. Dr. H. Foster Bain, Assistant Director of the U.S. Bureau of Mines, estimates that China possesses 300,000,000 tons of ore available for treatment by native methods and an additional 400,000,000 tons which could be smelted by modern furnaces. The iron ore deposits are now controlled by Chinese and Japanese interests. The production of pig iron in 1918 may be estimated at 500,000 tons, half of which was made in Shansi.—(*U.S. Com. Rep., Nov.* 27, 1918.)

Copper and Gold in China.—China appears to be poor in copper ore, Yunnan, which is the chief source of supply, producing less than is necessary for the coinage of the country. South-eastern Manchuria is mining copper, and a Japanese company has erected a copper smelter at Autung. The gold produced in 1915 amounted to 200,000 oz., 120,000 oz. coming from Manchuria and 60,000 from Outer Mongolia. The alluvium worked in Manchuria contains on the average 1·07 dwt. of gold per ton, but quartz veins are not considered workable if the gold content is below six dwt. per ton.—(*U.S. Com. Rep., Nov.* 27, 1918.)

Nitrate Production in Germany.—The nitrogen industry is suffering from the steadily diminishing supplies of coal. Some of the factories have ceased production. The total output to date is only about one-half of the pre-war normal demand (1914: 200,000 tons for agriculture, and 40,000 tons for industry), and in consequence prices will soon be increased. The present capacity of all factories is 300,000 tons, and the projected increase to 500,000 tons has been in complete abeyance since the outbreak of the Revolution.—(*Z. angew. Chem., Jan.* 31, 1919.)

Industrial Substitutes in Germany.—Since April, 1915, no cotton has been used in the manufacture of smokeless powder in Germany, its place being taken by cellulose obtained from German woods. Camphor, which up to seven years ago was imported from Japan, was then replaced by a product made synthetically from American oil of turpentine, but when the importation of this oil was stopped, the whole of the camphor required for explosive purposes was prepared from German materials. It is claimed that the new synthetic product is cheaper and better than that derived from oil of turpentine. A substitute for manganese in steel was discovered in February, 1916, and has been used ever since. New works for the production of the ferro-manganese substitute are also in course of erection. The introduction of nettle fibres as a substitute for cotton in textile fabrics has given excellent results, especially when they are spun with a small proportion of cotton waste. Nettle leaves have been used both as a feeding stuff for cattle and as a raw material for paper.—(*Weltwirtschaft Z., Nov.* 22, 1918.)

Petrol Substitute in Greece.—Owing to the shortage of petrol in Greece consequent on the Allied blockade in 1916, a new petrol substitute, "Motorine," was put on the market. It was composed of 80—90 per cent. of very pure turpentine, distilled from resin from the pine forests of Greece, and 10—20 per cent. of ether, which was also produced from native sources. The fuel was expensive and deposited a comparatively large amount of carbon in the cylinders, but this was easily removed.—(*U.S. Com. Rep., Nov.* 20, 1918.)

Prospects of the Swedish Chemical Industry.—The chemical industry of Sweden has rendered that country much service during the war. For example, the manufacture of carbide and of new explosives has been extended. Nitrogen manufacturers may expect strong competition from Germany, but having constructed their plant at peace prices should be able to meet this competition. The match trade has suffered from shortage of materials, and has lost part of its Eastern market to Japan, but it is hoped that the superiority of the Swedish match will again reinstate it in this market. Further, developments await the resumed import of raw materials, which is dependent on the amount of tonnage available and the conditions of exchange.—(*U.S. Com. Rep.*, *Dec.* 27, 1918.)

Claims of Employees in German Technical Industries.—The Hamburg section of the Association of Employees in Technical Industries has sent a circular to the different political parties to ascertain their attitude towards the fundamental demands of the Association. These demands include:—A legalised 8-hour working day. Summer holidays, and no Sunday work. Amelioration of the system of giving characters; the duty will be laid on the employer of stating exactly the special qualifications of the employee. Legal guarantee of the personal right of the employee to any inventions he may have discovered and to a share in any profits derivable from the same. Appropriate representation of technical employees in the Chambers of Labour, National Labour Office, and the central offices of the separate States. Penalties for employers who injure employees by confidential communications (black lists). The decision in all technical matters shall rest exclusively with professional experts; similarly all teachers of technical subjects in private and public schools must have had a technical training.—(*Hamburg. Correspond.*, *Jan.* 19, 1919.)

Barytes and Barium Products in the U.S.A.—The domestic output of crude barytes in the United States in 1917 was 18,808 short tons, valued at £234,000, a decrease of 7 per cent. in quantity and an increase of 16 per cent., or 4*s.* 7*d.* per ton, value over 1916. The chief production was from Georgia, Missouri and Tennessee. The crude barytes is principally used by manufacturers of ground barytes, lithopone and barium chemicals, in the industrial districts east of the Mississippi, north of the Ohio, in St. Louis, Mo., West Virginia, Tennessee, and Georgia. The imports of crude barytes are negligible. The expansion of the American trade in barium chemicals and lithopone in 1917 was very considerable, an increase of 5200 tons, or 30 per cent., being recorded. The sale of ground barytes decreased from 59,400 to 44,000 tons. The barium compounds imported into the United States in 1917 were chiefly lithopone with some precipitated barium carbonate, ground barytes and blanc fixe, valued at only £10,000, a decrease of 88 per cent. on the figure for 1916. This decrease was due to shipping restrictions on account of the war.

The domestic output of 44,000 tons of ground barytes in 1917 was ground by seven firms (chiefly in Missouri) and sold at an average price of 75*s.* per ton, as compared with 61*s.* 5*d.* in 1916. Ground barytes of fine white grade was quoted at £5 to £7 per ton early in 1917, but in March the minimum rose to £5 12*s.*, whilst the maximum fell to £6 8*s.* per ton, but rose to £7 4*s.* in September, 1917. Lithopone was made at 13 plants in the United States in 1917, the total output being 58,000 tons, chiefly produced in Philadelphia and New York. The average price in 1917 received by the manufacturers was 2·9*d.* per lb., as compared with the wholesale price of 3*d.* to 5*d.* per lb. Other barium compounds manufactured in the United States in 1917 were 7500 tons of barium carbonate, 4400 tons of barium chloride, 5700 tons of barium sulphate (blanc fixe) and 2700 tons of barium dioxide, hydroxide, sulphide, etc. The prices fluctuated considerably, but averaged 2*d.* per lb. for blanc fixe, 2*s.* 3*d.* per lb. for barium chlorate, 8*d.* per lb. for barium nitrate, 1*s.* 7*d.* per lb. for barium dioxide and 2*d.* per lb. for barium chloride.

A list of the chief manufacturers of lithopone and barium chemicals is published in *Mineral Resources of the United States*, 1917, 2, 285—291.—(*U.S. Geol. Surv.*, *Oct.*, 1918.)

LEGAL INTELLIGENCE.

Naphthalene Contract Dispute. *Collins and Burch, Ltd.* v. *Is. Poliakoff and Co., Ltd.*

In the Divisional Court, on February 17, before Justices Avory and Lush, Messrs. Collins and Burch, Ltd., moved to set aside the award of an arbitrator in favour of Messrs. Is. Poliakoff and Co., in connexion with a contract dated August 16, 1917, for naphthalene flakes. Under the contract respondents sold to the applicants 100 tons of material to be delivered at the rate of 25 tons monthly between September and December at £33 odd per ton, net cash against delivery. Only 30 tons were delivered. In the arbitration, applicants claimed damages in respect of failure to deliver the balance, also in regard to 8 tons not up to contract requirements and to applicants' refusal to take delivery of 9 tons which the latter said were too late and out of time. By the award the applicants were ordered to pay respondents £200 for breach of contract, and the ground for the motion was that the award was bad, because it was made by one arbitrator, whereas the submission to arbitration provided that an arbitrator should be appointed by each side, with a third to act as umpire.

Their Lordships held that the award was bad and must be set aside on the ground that the tribunal of arbitration was not properly constituted. The applicants were awarded costs.

Caustic Soda Contract Dispute. *William Drug Co., Ltd.* v. *Comet Chemical Co., Ltd.*

On February 18, in the Divisional Court, the Comet Chemical Co. moved to set aside an award, dated April 16, 1918, made in favour of the William Drug Co. in an arbitration relating to the supply of caustic soda to the latter, the damages awarded being £500.

The ground of the motion was that the award had been made by an arbitrator, who represented the William Drug Co., in the absence of the arbitrator appointed by the Comet Co., and that the award was not communicated to the latter company, which only heard of it accidentally months afterwards. Mr. Justice Avory ordered the award to be set aside, with costs.

Pre-war Enemy Phosphate Contracts. *Pacific Phosphate Co., Ltd.* v. *Chemische Fabrik Aktiengesellschaft vorm. Karl Scharff u. Co. and Others.*

Twelve actions brought by the Pacific Phosphate Co., Ltd., under the Legal Proceedings against Enemies Act, were heard in the King's Bench Division by Mr. Justice Bray on February 19. The defendants were: Chemische Fabrik A.-G. vorm. Karl Scharff und Co. of Breslau, Union Fabrik Chemischer Producte of Stettin, Merck'sche

Guano u. Phosphat Werke A.-G., of Hamburg, Anglo-Continentale (vorm. Ohlendorff'sche) Guano Werke of Hamburg, Chemische Fabrik A.-G. vorm. Moritz Milch und Co. of Posen, Silesia, Verein Chemischer Fabriken Breslauer Zweigniederlassung, Breslauer Chemische Fabrik A.-G., vorm. Oscar Heymann of Breslau, Schroeder u. Petzold Gesellschaft mit beschränkter Haftung, of Breslau, Dr. Roman May of Posen, Ceres A.-G. für Chemische Producte vorm. Th. Pyrkosch, "Clotilde" erste Ungarische A.-G. für Chemische Industrie, of Budapest, and "Donica" A.-G. für Chemische Industrie, of Budapest.

The cases related to contracts with enemy firms under which the plaintiff company was the seller of phosphates amounting in the aggregate to over half a million tons, for delivery over various periods of the years 1914-1923. The plaintiffs asked for declarations to the effect that all the contracts were dissolved as from August 4, 1914, by reason of the outbreak of war between England and Germany and Austria-Hungary.

Mr. Justice Bray granted the declarations asked for in every case, but made no order as to costs.

Excess Profits Duty Assessment. *Hedley and Co., Ltd.* v. *Income Tax Commissioners.*

On February 21, before Justices Avory and Lush, in the Divisional Court of the King's Bench, Mr. Palmer moved for a rule *nisi* for a mandamus directed to the General Commissioners for Income Tax for the Beacontree Division of Essex, calling upon them to hear and determine an appeal by Messrs. Hedley and Co., of Leytonstone, manufacturers of anæsthetics and dyes, against a decision of the Income Tax Commissioners assessing the company to excess profits duty. The rule raised a question of great importance under the Finance 1915 No. 2 Act in relation to the basis of assessment of excess profits duty.

Prior to the war a deduction had been allowed by the income tax authorities for development expenses, with the result that not only were the net profits for the pre-war years unduly low, and the basis upon which excess profits were to be assessed, but in addition the assessment of the excess profits for the post-war period was too high. The Commissioners had decided they were precluded from applying principles in determining the profits arising from appellants' trade or business for the purpose of excess profits duty other than those which had been applied in determining the profits of the said trade for the purpose of income tax. Their Lordships granted the rule.

Soap Trade Dispute. *Lever Bros., Ltd., and Associated Enterprises, Ltd.* v. *Brunner, Mond and Co., Ltd., and Others.*

Before Mr. Justice Bailhache in the King's Bench Division, on February 25 and 26, the plaintiffs sought for declarations, (1) that they were entitled to control and to have an equal voice with Brunner, Mond and Co., in the conduct and management of J. Crosfield and Sons, Warrington, and W. Gossage and Sons, Widnes, and (2) that the directors of these two firms nominated by Lever Bros. should have equal rights with the directors nominated by Brunner, Mond and Co. The case was a sequel to an action heard in 1917 which was settled on terms agreed, the plaintiffs now claiming that the defendants had not abided by the terms of the settlement. After Lord Leverhulme had given evidence, it was announced that a settlement had been arrived at, Lord Leverhulme proposing to withdraw the action, and to pay the taxed costs. Mr. Justice Bailhache assented and said that he felt there would be the very greatest difficulty in granting the declarations.

PARLIAMENTARY NEWS.

HOUSE OF COMMONS.

The Margarine Industry.

In answer to Mr. N. G. Doyle, Mr. G. Roberts, Minister of Food, said that this industry has now been developed to such an extent that it is not only able to supply all the needs of this country, but is also in a position to compete on favourable terms with foreign manufacturers in their own markets.—(Feb. 19.)

Excess Profits Duty.

Mr. S. Baldwin, Financial Secretary to the Treasury, replying to Capt. Shaw, stated that the Chancellor of the Exchequer is of the opinion that the present excess profits duty is not suited to be part of our permanent post-war system of taxation.—(Feb. 20.)

Waste Amatol.

Asked by Sir R. Winfrey concerning the disposal of waste amatol, Mr. F. G. Kellaway, Deputy Minister of Munitions, replied that instructions have been given to destroy 1400 tons of waste amatol; it will not be deposited in the Wash, but dumped into the sea, after consultation with the Board of Agriculture and Fisheries. The amatol in question contains about 10 per cent. only of ammonium nitrate. Whilst the extraction of the ammonium nitrate from this material would not be a paying proposition in view of the low ammonium nitrate content, he would be prepared to hand it over for use in agriculture at a nominal price, subject to any necessary safeguard.

Sir A. Griffith-Boscawen, answering another question put by the same member, said that the dumping of waste amatol into the sea was postponed until it was assured that no appreciable harm would be done to fish life.—(Feb. 20.)

Coal Mines (Output).

In a written answer to Commander Hamilton Benn, Mr. Bridgeman stated that the output of anthracite coal per man employed, based on the first six months of 1918, is 207 tons per annum, and of other coal in South Wales, 222 tons per annum. The corresponding figures for the United States, in 1916, were: Anthracite 548, and bituminous 896 short tons.—(Feb. 25.)

Coal Industry Commission Bill.

In introducing "a Bill to constitute a Commission to inquire into the position of and conditions prevailing in the Coal Industry," the Prime Minister urged the miners to postpone the projected strike until their demands had been thoroughly sifted by an impartial tribunal. These demands included: specially favourable treatment of miners in regard to demobilisation, an immediate rise of 30 per cent. in wages, a six-hour day, and better conditions generally. The probable effects of conceding these claims would be: to throw into unemployment thousands of workers in other industries, to cripple our export trade, to injure seriously shipping, smelting, engineering, and even the coal trade itself, and to endanger our food supply from overseas. The miners contended that other industries would not be damaged by the increased cost of coal; that even if they were, the claim for a higher standard of living would still be legitimate; and that the industry could bear the burden if waste were prevented. Mr. Lloyd George doubted if the increased cost of production (8*s.*—10*s.* per ton) could be covered by increased economies: that was a fit subject for inquiry. Some erroneous ideas were prevalent as

to the profits reaped by proprietors, but, taking all the collieries in the United Kingdom for the five years before the war, these were only 1*s.* per ton, with 6*d.* for royalties. The average wage of coal-getters was estimated at 81*s.* per week of 5 working days: that was not a starvation wage. However, he fully sympathised with the demand for better housing conditions. The terms of reference of the proposed Statutory Commission allowed of the compulsory attendance of witnesses, their examination on oath, and the compulsory production of documents. Mr. Justice Sankey would act as chairman. The Prime Minister then dealt with the demand for a reply on the question of wages and hours by March 15, *i.e.*, 16 days earlier than the Commission would be able to report. He could not believe that the miners would throw the whole country into confusion for the sake of 16 days. A protracted debate followed, in the course of which the miners' representatives urged that the demands for higher wages and shorter hours should be granted forthwith, leaving nationalisation and other questions to be settled by the inquiry. The second reading was carried by 257 votes to 43.—(Feb. 24.)

On the following day, when the Bill was considered in Committee, a motion to exclude the questions of hours and wages from the scope of the inquiry was negatived by 270 votes to 40. Mr. J. H. Thomas stated that in the event of a strike the miners, railway-men and transport workers would act together. Ultimately, the Prime Minister announced that if the miners would nominate representatives on the Commission, the latter would be able to report by March 20. This compromise was accepted, and the Bill was read a third time.—(Feb. 25.) The next day the Bill was passed by the House of Lords.

Ministry of Ways and Communications.

A Bill to set up a Ministry of Ways and Communications was introduced by the Home Secretary (Mr. Shortt). It is proposed that the new Ministry shall control all railways, light railways, tramways, canals and inland navigation; roads, bridges, vehicles and traffic; and the supply of electricity. In answer to interpellations, the Minister stated that the Bill would apply to the whole of the United Kingdom, including the Manchester Ship Canal.—(Feb. 26.)

Ministry of Health.

In opening the debate on the second reading, Dr. Addison explained that the main idea of the Bill is to centralise authority and to fix responsibility in matters appertaining to public health. First, the various Government Departments would be brought together, and the powers of the Local Government Board, the Insurance Commissioners, the Board of Education and the Privy Council would be amalgamated, the first two of these ceasing to exist. Later on it is proposed to take over certain powers of the Board of Control, the Ministry of Pensions, and of the Board of Education (medical inspection, etc.). The Medical Research Organisation with its Medical Research Committees would not be taken over, but be transferred to the Privy Council.—(Feb. 26.)

Gold Coast (Oil, Seed, and Kernel Legislation).

Colonel Wedgewood asked if the introduction into the Legislative Council of the Gold Coast of the oil, seed, and kernel legislation met with the unanimous opposition of the unofficial members; if the Governor stated that in these circumstances he would refer to Downing Street for instructions; and whether any instructions have been sent which will have the effect of forcing this legislation upon the Colony and Protectorate.

The Under-Secretary of State for the Colonies (Colonel Amery) replied that the facts were as stated, and that no instructions had as yet been given in the matter.—(Feb. 27.)

Munition Factories.

Mr. Kellaway informed Mr. A. Short that the Government does not propose to utilise the national factories to produce goods for sale in the open market, but it is considering the possibility of devoting some of them to the production of goods required for public services.—(Feb. 27.)

Quality of Gas Supply.

Asked by Sir Kingsley Wood if it was still necessary to depreciate the quality of London coal gas by "stripping" it of benzol, Mr. Bridgeman answered that, after careful investigation, the Board of Trade had decided that it was impracticable to revert at once to pre-war standards. Hence the Board had suggested to local authorities throughout the country that, until the end of June, no proceedings should be taken in respect of deficient calorific power so long as this did not fall below 450 B.Th.U., provided that the content of inert gases was not excessive.—(Mar. 4.)

REPORT.

Report of the Departmental Committee on Sulphuric Acid and Fertiliser Trades, 1919. [Cmd. 23, 2*d.*]

This report was drawn up early in 1918, but could not, in the national interests, be published in its complete form at that time. In view, however, of the importance of the subject a modified report was issued in February 1918 (this J., 1918, 118 R). The complete report, as now issued, contains in addition to the matter already published, statistical and other information regarding H.M. Factories. The following summaries must be read in conjunction with the previous abstract above mentioned.

The principal consuming trades, with their estimated annual consumption of acid (pre war) are set out in the following table:—

Annual Pre-War Consumption of Acid by the more Important Trades.

	Tons 100 per cent. acid per annum.	Equivalent. Chamber Acid.
Superphosphates	300,000	450,000
Sulphate of Ammonia ..	280,000	420,000
Bleaching Powder, Hydrochloric Acid, Alkali and Alum	186,000	279,000
Iron Pickling	70,000	105,000
Recovery of Grease in textile trades	20,000	30,000
Copper Sulphate	25,000	37,000
Dyeing and Bleaching ..	25,000	37,000
Dyes	Very small.	
Oil Refining	20,000	30,000
Explosives	30,000	45,000
	1956,000	1,433,000

The above figures are merely approximate estimates as no detailed statistics for the consumption of sulphuric acid before the war are available.

The comparison of the pre-war and post-war positions as regards productive capacity (also in terms of 100 per cent. and per annum) shows:—

	Pre-war Tons	Post-war Tons
Oleum	22,000	450,000
Chamber	1,040,000	1,265,000
	1,062,000	1,715,000

i.e., there will be a post-war surplus of 653,000 tons, of which the Government plants will produce 315,000 tons. The increased consumption which the Committee looks for after the war, especially in the

superphosphate industry, will absorb only about 300,000 tons, leaving a final surplus of about 350,000 tons. It is to avoid this surplus that the policy of scrapping and closing the least efficient works is recommended. As already reported, the Committee finds that the surplus acid can best be utilised in the development of the superphosphate industry: and in this connexion there is inserted in the new Report a recommendation to the effect that the Government should take immediate steps to secure an effective and permanent control or command of an adequate supply of phosphate rock, and make arrangements in advance for the importation of large quantities immediately after the termination of hostilities.

Some interesting figures are given of the production of fixed nitrogen in Germany.

GERMAN PRODUCTION OF NITROGEN.

(Calculated as Sulphate of Ammonia.)

1913		1917 (estimated)		Fixed Nitrogen
480,000 tons	Sulphate of Ammonia	700,000	=	140,000 tons.
30,000 ,,	Cyanamide	400,000	=	80,000 ,,
20,000 ,,	Ammonia Haber ..	500,000		100,000 ,,
750,000 ,,	Nitrate of Soda Imports ..	nil.		—
				320,000 ,,

The cyanamide and Haber processes may ultimately attain similar importance in this country, but at present they are, comparatively speaking, without influence. On the other hand, the introduction of synthetic methods for making nitric acid, now being put into operation, tends to diminish the consumption of sulphuric acid for the manufacture of nitric acid.

The following is a list of acid factories owned or leased by H.M. Government, with their output of 100 per cent. acid in tons per annum:—

A.—*Oleum Plants Erected During the War.*

		Tons per annum
H.M. Factory, Avonmouth ..	10 Grillos	89,200
H.M. Factory, Queensferry	10 Mannheims 10 Grillos	111,500
H.M Factory, Gretna ..	8 Mannheims 4 Grillos	53,500
R.N. Cordite Factory, Poole	2 Tentelew	8,900
H.M. Factory, Oldbury ..	2 Mannheims	4,500
H.M. Factory, Pembrey ..	6 Tentelew	26,700
S. Metropolitan Gas Co. ..	1 Grillo	8,900
		303,200

B.—*Chamber Plants Leased by H.M. Government.*

H.M. Factory, West Gorton ..	6,200 tons per annum.
Dalton Main Collieries	5,200 ,, ,,
	11,400
Total acid under Government management	314,600

The Avonmouth plant had already been leased to Mr. Tilden Smith for use in connexion with zinc concentrates before the Committee was appointed, and therefore the latter is obliged to regard the agreement as a *fait accompli* and to restrain from comments. However, it points out that this factory is badly situated from the point of view of disposal of sulphuric acid, considerations of transport demanding that the acid should be utilised in manufactures carried out in the factory itself. The Committee recommends that this question be referred to the Joint Committee (representing manufacturers and users of sulphuric acid), and that if the latter so recommends, the Government should reopen the whole question of the agreement. The Gretna factory is very badly placed for the manufacture of acid or superphosphate for sale, and the Queensferry plant is poorly situated both for consuming centres and for import of raw materials.

OFFICIAL TRADE INTELLIGENCE.

(*From the Board of Trade Journal for February 20 and 27.*)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 73 Basinghall Street, London, E.C. 2, from firms, agents or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

LOCALITY OF FIRM OR AGENT	MATERIALS	REFERENCE NUMBERS
Australia ..	Metals, chemicals and dyes	244, 309
,, ..	Chemicals, drugs, paper ..	311
,, ..	Glassware for incandescent and electric lamps	312
,, ..	Heavy chemicals ..	313
,, ..	Carborundum discs, heavy oils, greases	*
,,	Chemicals, drugs, etc. ..	293/4 1†
Canada ..	Glass and china	248
,, ..	Soap, druggists' sundries	318
,, (Nova Scotia)	Fireclay and firebrick ..	‡
India (Cocanada)	Dyes, paints, matches, etc.	280
Belgium (Liége)	Faience and earthenware tiles, waterproofing material for cement, etc.	238
Paris	Colours, varnish, paints	294, 296
,, ...	Iron, steel and other metals	299
Lyons	Colours, oils, fats ..	326
Italy (Turin) ..	Plant to produce 1 to 1½ tons per day of lithopone (tender for) ..	266
Spain (Vigo) ..	Lead, tinplate, copper-sulphate, paper, etc. ..	263
,, (Barcelona)	Chemicals, dyes, drugs, vegetable oils, copra, etc.	264
Dominican Republic ..	Iron, steel, textiles, glassware, etc.	325
Norway ..	Pig iron, iron wire ..	328
South and Central America	Chemicals, soap, paper ..	333

* Official Secretary, Commonwealth of Australia, Commercial Information Bureau, Australia House, Strand W.C. 2.

† High Commissioner for Australia, Australia House, London, W.C. 2.

‡ High Commissioner for Canada, 19 Victoria Street S.W. 1.

H.M. Consul-General at Antwerp reports that persons and firms in Belgium desire agencies for U.K. manufacturers of metals, chemicals, candles, soap, cement, drugs, dyes, earthenware, glass, china, enamelware, gums, inks, leather, linoleum, matches, margarine, oils, ores, paint, varnish, rubber, paper, starch, etc. Inquiries to Department of Overseas Trade (Belgian Section), Canada House, Kingsway, W.C. 2, quoting reference number Ex. 889 T. and R.

TARIFF. CUSTOMS. EXCISE.

British India.—Among the articles included in the new Schedule of Tariff Valuations are alcoholic beverages, vinegar, margarine, sugar, gums, resins, hides and skins, ores, oils, tallow, stearin, candles, wax, manures, wood pulp, ferrous sulphate, many dyes, drugs and chemicals, glass, earthenware, metals, paper, matches, oilcakes.

Brazil.—The articles affected by the new Customs law include leather, earthenware, porcelain, cardboard, certain chemicals, oils and colours.

Canada.—All goods imported from Belgium must be accompanied by a certificate of origin and interest issued by a British Consular Officer in Belgium.

A drawback of 99 per cent. is allowed, under certain conditions, on all the duties paid on liquid sulphite pulp used in the manufacture of newsprint paper on or after March 1, 1917, and on or before June 30, 1918.

Costa Rica.—Certain chemicals and serums are exempted from Customs duties, under certain conditions, as from November 30 last.

Federated Malay States.—The import duty on petroleum is fixed at 5 cents per gallon as from December 16, 1918.

France.—The import of Russian money is prohibited, except under licence, as from January 22.

A Bill has been submitted to the Chamber of Deputies which proposes to place under Customs control all factories engaged in refining petroleum and to limit the importation of crude oils to such factories.

Japan (Corea).—All export duties now in force in Corea will be abolished on April 1 next.

New Zealand.—The Orders in Council prohibiting the import of soap except when manufactured in or exported from the U.K., British Possessions, France, Italy or Japan are revoked as from December 2, 1918.

Spain.—A system of export control has been established whereby the Government will fix the total quantity of any commodity which may be exported during the current year, and will levy an export duty to vary with the price of the article in the Spanish market.

United States.—It is proposed to amend the Customs duties on dyes, intermediates, photographic chemicals, medicinals, flavours, synthetic phenolic resins and explosives, in order to promote the development of the coal tar and dye industries.

TRADE NOTES.

FOREIGN.

The Bordeaux Fair.—H.M. Acting Consul, Bordeaux, reports that the Annual Fair opens on May 31 and will continue until June 15.—(*Bd. of Trade J., Mar.* 6, 1919.)

The Aniline Dye Situation in Italy.—Practically all the aniline dyes imported into Italy prior to the war came from Germany, and there was always a large demand in the Italian market for them on account of their excellent quality and cheapness. At the outbreak of hostilities the large stocks of dyes on deposit with Italian firms were immediately purchased at prohibitive prices by the principal factories, leaving the market completely bare. Several manufacturers attempted to produce dyewares similar to those furnished by Germany, but after a series of experiments and financial losses, only a poor red and reddish black, not at all "fast," were obtained, which buyers were forced to accept. In consequence, local dealers and importers have since experienced much difficulty in inducing customers to accept unknown qualities of dyestuffs of foreign manufacture. The managers of several new plants for the manufacture of aniline dyes state that they cannot produce solid, guaranteed colours owing to lack of proper machinery, which has not been imported because of the high rates of exchange and the difficulties of ocean transit.

There is still a strong prejudice in favour of German dyes, and the establishment of a market for American dyes can be effected only by personal investigation, and by convincing buyers that the products offered are as good as those of German origin. The opinion has been expressed in the Turin district (one of the most important manufacturing centres) that were an American firm to establish a branch factory in Italy the products would find a ready market at good prices. The system of selling goods in deposit and quoting prices in lire is much in favour with Italian firms, and it would be well to consider this established custom in endeavouring to develop a dye trade with Italy.—(*U.S. Com. Rep., Jan.* 29, 1919.)

American Dyes Institute.—An amalgamation has been ratified between the American Dyestuff Manufacturers' Association and the American Dyes Institute, the new association to be known as American Dyes Institute (an association of American dyestuff manufacturers).

Both of the old organisations are the outgrowth of war conditions. The American Dyestuff Manufacturers' Association was limited in membership to actual producers of dyes in the United States to the exclusion of those who were simply dealers or importers. Its object was to consolidate the domestic industry in order that there might be a united effort toward the furtherance of their general commercial and governmental interests. The American Dyes Institute was formed simply to further the "open price" idea, a proposition that has been subjected to more or less violent discussion. It is proposed that while the two organisations will be united, there will still be independent action between them and the members of one section will not necessarily subscribe to the actions of the other. It is hoped, however, that some method may be formulated whereby the interests of all parties will be mutually served. A committee, composed of Messrs. F. Hemingway, M. R. Poucher and W. F. Miller, is to nominate officers for the new association.—(*Textile Colourist, Jan.*, 1919.)

Chilean Nitrate Industry.—The Allied Committee having declared that it will make no new purchases, the situation of the Chilean nitrate industry is becoming serious. In order to provide relief the Minister of Finance is about to present to Congress a bill for the appropriation of £1,200,000 sterling to be used to purchase nitrate on Government account, to enable *oficinas* to resume work. A 40 per cent. export duty is to be imposed upon companies which do not associate themselves with the Government plan.—(*U.S. Com. Rep., Jan.* 22, 1919.)

Ecuador in 1917.—The demand for Ecuadorian products during 1917 made that year a very prosperous one for the Republic. The exports included 83,000,000 lb. of cacao, 2,217,529 lb. of hides, 352,804 lb. of ivory nuts and 239,018 lb. of rubber. Ecuador produces annually about 12,000,000 lb. of lard, all of which is consumed in the interior, while in addition 2,502,063 lb. was imported in 1917. About 45,000 cases of petroleum were imported from the U.S.A. and the American-owned oil wells in Peru. The common soap imported from the U.S.A. in 1917 amounted to about 2,000,000 lb. Towards the close of the year there was a grave soap shortage which was ameliorated by large shipments from Great Britain.

Ecuador is the home of the cinchona tree and of numberless medicinal plants which will repay research. Many curious Ecuadorian vegetables and fruits are being investigated by the United States Department of Agriculture, and the Smithsonian Institution is making a thorough study of the botanical resources of the Republic.—(*U.S. Com Rep., Nov.* 18, 1918.)

The Monazite Sand Situation in Brazil.—Brazilian monazite sand is usually sold in the Rio de Janeiro or the Victoria market. Before the war, when the German trust ruled the market, all shipments were made through Rio de Janeiro firms. The following are the only firms at present engaged in the business and operating their own mines:

P. S. Nicholson and Co., Rua Visconde de Inhaúma 8, Rio de Janeiro; H. M. Sloat, Avenida Rio Branco 109, Rio de Janeiro; and the Société Minière, Rio de Janeiro. The inclusive cost of mining, transporting and concentrating the sand averages between $17 and $23 (£3 9s. 9d. and £4 7s. 3d.) per ton. The only mines worked at present are in the Carapebus district, but those in the Guarapary district will soon be re-started. The present uniform price for material delivered at Victoria is approximately $25 (£5 2s. 8d.) per unit of thorium. Owing to storage cost, stocks of sand at Victoria and Rio de Janeiro are kept at minimum quantities. Thorium content cannot be satisfactorily determined locally, so that estimates are subject to modification.—(*U.S. Com. Rep.*, Dec. 13, 1918.)

Trade Prospects in China.—It is only within recent years that the wonderful wealth of China in natural resources and raw material has attracted the attention of Western nations. The Chinese themselves have done little to develop these resources, and foreign nations have had to do the little that so far has been done. Germany was particularly active in this respect, and it is estimated that 75 per cent. of the Chinese exports to the United States was in German hands. The war offered China great opportunities, but lack of ships, internal disorders and absence of trained native organisations, together with currency difficulties, prevented her from taking full advantage of them. Nevertheless, trade has expanded enormously during these years, and one has only to study the case of Japan, whom the war has converted from a debtor to a prosperous creditor nation, to realise how great this expansion might have been. Japan, by means of preferential freight rates on its Government-subsidised ships, is able to assure its merchants more and cheaper shipping space than any foreign merchant, so that it is rapidly capturing Chinese trade.

Among the many products essential to Western industries may be mentioned bean oil, wood oil rapeseed oil, peanut oil, etc. (the total trade in which amounts to £20,000,000), vegetable tallow, nutgalls, hides and skins, egg products, peanuts, antimony, tin and tungsten. Western importers and manufacturers will have to pay heavily for these products, unless they can handle them through their own organisations and on their own ships. The exportation of Chinese products has developed into a big trade, but it is small compared with its potentialities. Railways, roads, a stable currency and internal peace in China will open to the world a storehouse of mineral, vegetable and animal products of incalculable value.—(*U.S. Com. Rep., Nov.* 27, 1918.)

The Japanese Camphor and Celluloid Industries.—According to the Japanese Press, steps are being taken to amalgamate into a large company a number of small undertakings engaged in producing crude camphor in Formosa. This company, it is said, will have a capital of 6,000,000 yen, and it proposes to increase the output of crude camphor. Celluloid manufacturers in Japan have recently suffered from the cessation and cancellation of orders, and the new official inspection system has interfered with the business of the smaller manufacturers. A petition has been presented to the Government to have these regulations removed. It is considered that the boom in the manufacture of celluloid is over, and the prospects of allotting larger supplies of camphor to consumers abroad are stated to be better. The monthly camphor allotments from January 1 to March 31 are: Great Britain, 87,000 kilo.; France, 37,500 kilo.; United States of America, 282,000 kilo.—(*Bd. of Trade J., Mar.* 6, 1919.)

COMPANY NEWS.

BRADFORD DYERS' ASSOCIATION, LTD.

At the annual meeting held in Bradford on February 28, Mr. Milton S. Sharp, chairman, in the course of a lengthy speech, referred to the present industrial unrest, to the British dye industry, and to the financial position of the company.

Owing to the policy of limitation of output, Sir A. Yarrow is contemplating the removal of his shipbuilding works from the Clyde to Vancouver, and similar proposals are being considered by other industrial firms paying an aggregate total of £2,000,000 per annum in wages. The directors of the company have closely investigated the probable effects which would result if the present demands of labour were conceded, and have come to the conclusion that a large percentage of the company's export trade would be immediately lost, and a still larger percentage placed in most serious danger.

The paramount importance of possessing an independent national dye industry is now recognised both by H.M. Government and by the Colonial Governments; and the fact that in its latest report the Bayer Company admits that 96 per cent. of its production during hostilities was for the German Government shows the national value of such establishments in time of war. The acceptance by Lord Moulton of the chairmanship of the British Dyestuffs Corporation has given unbounded satisfaction to colour users generally, and is of particular importance as he possesses in most remarkable measure the confidence of the Swiss colour makers; and it is to be hoped "that one of the first fruits of his appointment will be some arrangement with the Swiss which will appreciably further the attainment of the great object we have in view." The oft-repeated statement that in this country production to the value of £200,000,000 per annum is dependent on aniline dyes is an underestimate; in the United States the value is £500,000,000, in France and Italy £200,000,000, giving a total for the four countries of at least £900,000,000 a year. As with two exceptions all the German dye works are within the territory occupied by the Allied Forces, the Peace Conference will not fail to protect this vast production from any peril arising out of the dye situation. These works should be at once surveyed in order to determine what action should be taken to protect all production in Allied countries dependent on dyes.

The trading profits for 1918 show a considerable decline, partly owing to the exhaustion of the good forward purchases made in 1914, and partly because the profits of the United States branch have not been included, the question of excess profits duty being still in abeyance. The net profits were £576,900 as against £760,200 in 1917. In spite of this the dividend and bonus distribution is maintained at 17½ per cent.

SOUTH STAFFORDSHIRE MOND GAS CO., LTD.

The annual meeting was held on February 25 at Dudley Port, Mr. Robert L. Mond presiding. In moving the adoption of the report he stated that despite the fact that a Bill for extending the plant was brought in, at the request of, and by arrangement with, the Ministry of Munitions, the Government had refused to allow the company to make use of its provisions, and had compelled it to pay the whole cost of the promotion. The demands of customers had been met until the armistice was signed; since then they had fallen

off slightly. The uncertainty as to the costs of fuel and labour unsettled everything; until these were put upon a reasonably stable footing it was not possible to forecast the future. Research work with regard to the better utilisation of residuals had had encouraging results; and the directors had ordered plant to deal with the tar as the first instalment. This should be at work by the early summer. Owing to sulphate of ammonia being controlled and having to be sold at fixed prices out of all proportion to the increased cost of manufacture, the net revenue from this item was much lower than it ought to have been. Application would shortly be made to the Board of Trade to allow the company again to increase the price of gas, and he had no doubt that it would be granted.

The report was adopted and a dividend at the rate of 6 per cent. per annum authorised to be paid to the preference shareholders.

GOVERNMENT ORDERS AND NOTICES.

PROHIBITED IMPORTS.

By the Prohibition of Import (No. 28) Proclamation, 1919, made on February 25 last, the unlicensed importation of intermediates and of all synthetic dyewares was made unlawful. The following materials are specified: All derivatives of coal tar generally known as intermediate products capable of being used or adopted for use as dyestuffs, or of being modified or further manufactured into dyestuffs.

All direct cotton colours, all union colours, all acid wool colours, all chrome and mordant colours, all alizarine colours, all basic colours, all sulphide colours, all vat colours (including synthetic indigo), all oil, spirit and wax colours, and any other synthetic colours, dyes, stains, colour acids, colour bases, colour lakes, leuco acids, leuco bases, whether in paste, powder, solution or any other form.

This prohibition does not apply to any such goods which are imported under licence given by or on behalf of the Board of Trade, and subject to the provisions and conditions of such licence.

With reference to the above Proclamation, the Board of Trade has given notice that this prohibition will be administered by the Trade and Licensing Committee. For the present, however, a general licence has been given for the import of all dyestuffs and other products covered by the prohibition which are of *bona-fide* French, American or Swiss origin, and it will, therefore, not be necessary at present to obtain licences in respect of individual consignments proceeding from these countries.

Any communications regarding the prohibition should for the time being be addressed to the Secretary of the Trade and Licensing Committee, Dyes Department, Board of Trade, 7 Whitehall Gardens, S.W. 1; but the Committee proposes shortly to open offices in Manchester, when it will be prepared to deal with inquiries and correspondence there. A further announcement will be made later of the address of the Manchester office.

Importation of molasses, etc. The Board of Trade has issued a General Licence to the Board of Customs admitting on and after February 24, "Molasses and invert sugar and all other sugars and extracts from sugar which cannot be completely tested by the polariscope, and on which Customs duty is not otherwise charged." So long as this General Licence remains in force no import licence will be required in respect of those articles.

PROHIBITED EXPORTS.

The following is a list of materials and articles upon which existing export prohibitions have been relaxed:—

Headings transferred from one list to another.

From List A to List C.

Candles; flax waste.—(Feb. 20.)

Baking powder; fatty acids; machinery, textile; tallow and articles, mixtures and preparations containing; wax, carnauba; waxes, composite; enamelled copper wire; wool grease. Chemicals:—Tolu balsam; nux vomica.

From List B to List C.

Iron tubes; molybdenum filament; steel tubes; tungsten filaments for electric lamps.—(Feb. 20.)

Waxes, animal, mineral and vegetable not otherwise prohibited.—(Feb. 27.)

Altered headings.

(A) Hides, wet, salted, cattle. (C) Hides not otherwise prohibited. (A) Honey. (C) Articles, mixtures and preparations containing honey not otherwise prohibited. (A) Invert sugar. (C) Articles, mixtures and preparations containing invert sugar not otherwise prohibited. (A) Yeast. (C) Articles, mixtures and preparations containing yeast not otherwise prohibited. (A) Woollen rags (other than pulled rags) applicable to use otherwise than as manure or as roofing felt rags. (C) Shoddy and mungo.—(Feb. 20.)

(A) Oils and fats, edible, including blends of two or more edible oils or fats. (C) Oils and fats other than edible, and articles, mixtures and preparations containing such oils and fats. (A) Resins. (C) Resinous gums and resinous substances.—(Feb. 27.)

Export of albumin, egg yolk, etc., to Holland and Sweden.—The embargo on the import of albumin, egg yolk and dried eggs into Holland and Sweden has now been raised. Applications for export from the United Kingdom will be granted freely, subject to the production of the usual guarantees against re-export, and until such time as the quantities which may be imported by those countries have been reached.

Resumption of trade with the Adriatic Coast.—The Board of Trade has issued a General Licence authorising the resumption of trade with Croatia and Slavonia, Bosnia and Herzegovina, Montenegro and Albania. Export and import licences must still be obtained from the War Trade Department before shipping or importing. The whole of the Adriatic Coast and all the countries of the Balkan peninsula are now open to trade.

NEW ORDERS.

The following Orders have been made by the Minister of Munitions:—

The Flax Scutching (Ireland) Order, 1919. (Feb. 21.)

The Magnesite (Suspension) Order, 1919. (Feb. 25.)

The Building Bricks Control (Partial Suspension) Order, 1919. (Feb. 28.)

The Small Tools (Suspension) Order, 1919. (Feb. 28.)

The Converter Plant Control (Suspension) Order, 1919. (Mar. 4.)

The Rosin Control (Suspension) Order, 1919. (Mar. 4.)

The Calcium Carbide (Suspension) Order, 1919. (Mar. 7.)

REVIEWS.

Recent Advances in Organic Chemistry. *By* A. W. Stewart, *with an Introduction by* J. Norman Collie. *Third edition. Pp.* xiv + 350. *(London: Longmans, Green and Co.* 1918.) *Price* 14*s. net.*

Since 1904 the Chemical Society has published annual reports on the progress of chemistry, and recently a similar publication has been issued by the Society of Chemical Industry on the progress of applied chemistry. These volumes are excellent in themselves, but lack continuity. No decision, apparently, has yet been made to publish decennial reports which would collate the material of the annual reports, although there is little doubt that such publications would be of the greatest value to chemists. Until official action is taken the gap must be filled by private enterprise.

The book under review is an attempt to do this in the section of organic chemistry and it suffers from the chief disadvantage of its class—namely, that there is not enough of it. Limitations of space have undoubtedly caused much important matter to be excluded and some of the chapters would have been improved by expansion. However, until some energetic organic chemist writes the ideal text book, which should be a series of volumes starting with a general treatise on the principles of the science followed by monographs on special sections, which could be kept up to date as occasion requires, we must perforce be content with an incomplete and therefore unsatisfactory treatment of the subject.

Surely no one in their senses would think of teaching organic chemistry on the lines of Richter's Handbook. Indeed if any lecturer attempted to do this he would, without doubt, be subjected to personal violence long before his course was half through. Yet this handbook is the standard publication for advanced students both in this country and in America; and there is, at present, no alternative unless one has recourse to a number of books no one of which is complete in itself and all of which overlap.

Where the author of the present book has given himself full scope, as for example, in the chapters on the terpenes and the alkaloids, his treatment of his subject is so admirable and the general descriptive account so well put together that disappointment is all the more acute when one realises what he has omitted in his treatment of other sections. For example the chapters on "Rubber," "Some Aromatic Derivatives of Arsenic" and "The Polypeptides" should either have been treated more fully or excluded altogether.

Chapter X is entitled "Some Theories on the Natural Synthesis of Vital Products" and embodies certain notes which the author has received from Prof. Collie. This section is of absorbing interest and will well repay perusal. It contains numerous suggestions, many novel, all fascinating, and is indeed one of the most striking contributions to the subject which has yet appeared.

The book starts with a chapter on "Organic Chemistry in the Twentieth Century," which might have been extended with advantage, and finishes with a chapter on "Modern Formulæ and their Failings," in which the author discusses the present system of notation and points out some of its shortcomings. There is, however, no necessity to make remarks on the condition of the scientific mind, because the system serves admirably for the present purposes of the organic chemist. The main trouble has arisen because physical chemists will strive to read into our formulæ properties they were never intended to connote, and the author himself is not guiltless in this matter, because the theory of isorropesis, which was advanced by him in conjunction with Baly, while not supported by one shred of chemical evidence, was, nevertheless, given expression in terms of our notation. By all means let physical chemists devise their own notation, and if it explains the occurrence of absorption bands no one will be more willing to offer his congratulations than the present writer.

Occasion is taken to express disapproval of "the flood of synthetic material which pours chiefly from the German laboratories." But surely the need for any such expression has now disappeared. It is exceedingly unlikely that any publishing body—certainly not the Chemical Society—would nowadays publish any paper which contained merely a list of compounds and their properties without any fundamental point being involved. The "chief object" is not "merely to supplement the already existing myriads of laboratory-made organic compounds" but to obtain advances, however slight, in our knowledge of the science.

In conclusion one cannot help feeling that the author has attempted to cover too wide a field in too small a space, and that this may affect the value of the book from the point of view of the student. For the research worker, however, who is competent to read between the lines as well as between the chapters, it should prove of the greatest value as it will enable him to obtain a clear view of the activities in fields other than his own.

The book is well put together and reflects great credit on the printers and proof-readers. The usual pentavalent carbon atom is absent and the formulæ are clearly printed. A purist might object to the use throughout of the Kekulé formulæ as being expensive and unnecessary as well as misleading, but this is a minor disadvantage in a work which is really wanted.

J. F. Thorpe.

Applications of Electrolysis in Chemical Industry. *By* A. J. Hale. *Monographs on Industrial Chemistry, edited by* Sir Ed. Thorpe. *Pp.* viii + 148. *(London: Longmans, Green and Co.* 1918.) *Price* 7*s.* 6*d. net.*

This book forms an excellent text-book for students commencing the study of industrial electrochemistry. The older processes are fully and well described, including many no longer in use, more recent developments receiving very brief notice. The general arrangement of the subject matter is, however, clear and good.

The introduction is quite elementary, and little modern theory is discussed. The decomposition voltage of water is given without comment as 1·7 volt instead of the usually accepted value of 1·13, and the section on overvoltage is out of date. The first chapter, on methods of generating the current, includes a short account of primary and secondary cells, dynamos and converters, together with a section—rather too short—on the cost and distribution of power. In the chapter on metal refining, copper, silver, and gold are very well and fully treated, complete data as to costs, composition and treatment of slimes, and output from certain works being given. Lead receives rather less attention, and the short section on electrolytic iron is inadequate. The account of aluminium manufacture is rather too short and not up to date, but the sections on sodium and calcium are good, especially the former. The preparation of cerium for the important pyrophoric alloys is not referred to.

A chapter on the electrolytic manufacture of oxygen and hydrogen forms a useful feature of the book, but that on chlorine and caustic soda is certainly the best in the volume. Seventeen cells are described and illustrated by eighteen diagrams, a useful table of comparative efficiencies for some of the cells is given, and the chapter concludes with a short discussion of the future of this industry.

The book would be greatly improved by the introduction of illustrations showing actual plant in operation. References are given throughout to scientific journals and patent literature, but most of them are from 10 to 20 years old. E. NEWBERY.

INDIGENOUS DRUGS OF INDIA. *By* J. C. GHOSH, *B.Sc.(Manch.). Pp.* 32. *(Calcutta: Butterworth & Co. (India) Ltd.* 1918.) *Price* 1*s.*

The principal value of this brochure lies in its suggestion of the potentialities for the development for the benefit of the Empire of some of the natural resources of India. The European war has taught us the necessity for independence in the provision of chemicals and medicinal products for our own need, and it is comforting to learn from Mr. Ghosh's treatise that about 50 per cent. of the total number of vegetable drugs in the British Pharmacopœia is indigenous to India and Ceylon, and that nearly all the remainder could be cultivated. Moreover, many of these are important drugs, such as belladonna, digitalis, henbane, ipecacuanha, nux vomica, from which valuable alkaloids are isolated. In this connexion Mr. Ghosh advocates a systematic and scientific cultivation of the B.P. vegetable drugs, properly trained manufacturing pharmacists working in collaboration with drug growers. He also advocates the establishment in India of alkaloid manufacture as an industry, either under Government control or by private enterprise. He points out that in India there already exists an important nucleus for an alkaloid industry in the production of Government quinine. There are likewise great possibilities, he states, in the still unexplored fields of Ayurvedic drugs, but he strongly urges the need for a Food and Drugs Act for India to control the indiscriminate foisting on an ignorant native population of worthless drugs by unscrupulous manufacturers. A very useful appendix gives a list of the vegetable drugs mentioned in the B.P. 1914, with the names translated into eight native languages—Sanskrit, Tamil, Telugu, Canarese, Malaylam, Bengali, Hindustani and Mahrati. W. CHALMERS.

"COAL TAR DYESTUFFS," by C. M. WHITTAKER.—In connexion with the review of this work published in our issue of January 31 (35 R—36 R), we have received a letter from a correspondent complaining of the unfairness of the reviewer in criticising the "curious English" used by the author. The first quotation given by the reviewer is admitted to deserve that stigma, but excused on the ground that it is "the language of the practical man and is readily understandable by anyone with dye-works experience." The second quotation is condemned as unfair because the paragraph-heading "Mordant Dyes" was omitted, thus creating the impression "that the author was writing in an incomprehensible manner." On referring to the review in question we find that the main criticism of this passage was directed against the unnecessary use of a colloquialism: and the added remark that the sentence "was not even informing" appears to us to be fair criticism.

We should like to take this opportunity to emphasise the necessity for the use of lucid and grammatical English in scientific and technical publications. Apart from violating the canons of literary taste, the use of workshop slang, or of nebulous or redundant language entails a considerable waste of time to the reader, in addition to causing him unnecessary "vexation of spirit." Devotees of the classical cult have long jibed at the scientist who cannot express his thoughts in clear and polished phrases, and they are wont to associate this defect with modern education in the natural sciences. The evidence rather points to the contrary. An educational experiment carried out a few years ago at one of our Naval Colleges showed unmistakably that an increase in the time devoted to workshop and other practical studies, at the expense of the purely literary portion of the curriculum, was attended by a marked improvement in literary expression. "Sloppiness" of style, unless it is a result of carelessness, is a natural consequence of unclear thinking, of which scientists are certainly not more guilty than others. There is nothing in the nature of his occupation to debar the writer on scientific subjects from attaining a style as clear, terse, grammatical and finished as that of some of his literary compeers. Although literary style is to a very considerable extent a matter of taste, and as such not amenable to the rules of logic, we venture to express the opinion that our reviewer not only kept his remarks within the limits of honest criticism, but rendered a distinct service in drawing attention to certain crudities of style in the book which he reviewed.

OBITUARY.

THOMAS FAIRLEY.

It is with great regret that we record the death, on February 21 last, of Mr. Thomas Fairley, the Leeds City Analyst, at the age of 76.

Mr. Fairley was born in Glasgow and had the good fortune to study chemistry under the late Lord Playfair at Edinburgh University, subsequently serving under him as tutorial assistant. After a few years devoted mainly to teaching, he set up as an analytical and consulting chemist, and his first important appointment was that of public analyst for Leeds and the North Riding. During his long period of activity he filled many honorary posts, including that of chairman of the Council of the Association of Technical Institutions of Great Britain and Ireland.

Mr. Fairley took a great interest in the Society of Chemical Industry, and the Yorkshire Section, which he served both as chairman and as secretary, owes much to him for his keen interest and support. He retired from the secretaryship only last year. Mr. Fairley had extensive knowledge of many subjects and was of wide literary sympathies; his scientific writings include contributions to the Journal of the Chemical Society, to the Journal of this Society, and to Thorpe's Dictionary of Chemistry.

PUBLICATIONS RECEIVED.

OSMOTIC PRESSURE. MONOGRAPHS ON INORGANIC AND PHYSICAL CHEMISTRY. *By* A. FINDLAY. *Second edition. Pp.* 116. *(London: Longmans, Green and Co.* 1919.) *Price* 6*s.*

COAL TAR DYES AND INTERMEDIATES. *By* E. DE BARRY BARNETT INDUSTRIAL CHEMISTRY, *edited by* S. RIDEAL. *Pp.* 213. *(London: Baillière, Tindall and Cox.* 1919.) *Price* 10*s.* 6*d.*

AMERICA AT SCHOOL AND AT WORK. *By* H. B. GRAY. *Pp.* 172. *(London: Nisbet and Co.* 1919.) *Price* 5*s.*

CHEAP STEAM, VOL. II., 1918. *Pp.* 96. *(Bolton: Ed. Bennis and Co.) Price* 10*s.* 6*d.*

PRELIMINARY NOTE ON THE RESEARCH WORK UNDERTAKEN FOR THE DEVELOPMENT OF INDIGENOUS DRUGS OF THE GWALIOR STATE. MONOGRAPH NO. 1. *By* PROF. M. J. GAJJAR *and* M. R. ENGINEER. *(Gwalior: Alijah Durbar Press.* 1918.)

A SCHEME OF INDUSTRIAL FELLOWSHIPS FOR INDIA. *Compiled by* M. J. GAJJAR. *Pp.* 32. *(Bombay: C. S. Deole at the Bombay Vaibhav Press.* 1918.)

CHEMICAL ENGINEERING GROUP.

That the formation of the first Subject Group of the Society of Chemical Industry has met with general approbation may be inferred from the very satisfactory progress which has resulted from the preliminary efforts of those who are primarily responsible for the innovation. In less than three months since the first appeal was published in this Journal, some 400 members have joined the new branch, and from the vigour that is being displayed it seems not improbable that this number may be greatly exceeded in the near future.

In one or two quarters the fear has been expressed that the concentration of effort in this direction may deflect its flow from the customary channels, in other words that the Local Sections may in future find it more difficult to obtain papers on chemical-engineering subjects than in the past. We believe this fear to be unfounded. In the first place the conferences projected by the new Group will be held only in those localities where they will be welcome; and secondly, the subject is such a vast one and its pursuit fraught with such great possibilities, that by stimulating interest in the subject the propaganda work of the Group is more likely to gather grist for the Sectional mill than the contrary.

It has also been urged that the promotion of chemical engineering was one of the original objects of the Society, and that the existing organisation affords all the means necessary to its development. This is undoubtedly true—on paper, but experience has shown that although many valuable contributions to this subject have been made to the Society in the past, this branch of industrial chemistry has not progressed to the extent which was, and is, desirable. Hence no objection should be taken to the institution of some new means of aiding its development.

The problem of defining the chemical engineer and his status does not appear to be an object of immediate importance, but it is essential that everyone should realise that the Chemical Engineering Group is open to all industrial chemists who have an interest in engineering, and to all engineers who are interested in industrial chemistry, and further, as the transition from laboratory to factory always involves the application of engineering knowledge, it follows that there can be but few industrial chemists who could not with advantage become members of it. It is, however, from the national point of view that we would especially emphasise the importance and potentiality for good of the new Group; at the same time we are not oblivious to the consideration that its success would react upon the parent body by increasing its membership and enlarging its sphere of influence and utility.

The inaugural dinner, which is referred to elsewhere in this issue, was a noteworthy event and in every way indicative of the spirit of progress which has been manifest in the Society for some time past. Although some disappointment was caused by the unavoidable absence of one or two of the more distinguished guests, the gathering was in all other respects worthy of the occasion. Those who had the good fortune to be present cannot have left the assembly without the impression that the Group had received the most hearty inauguration, and the conviction that its future will be one of activity and utility in the interests of chemical industry and of national prosperity.

CHEMICAL STANDARDS IN RELATION TO THE IRON AND STEEL TRADES.

H. W. BREARLEY.

The paper on Chemical Standards appearing in the issue of February 15 (p. 15 T) revives a discussion which comes periodically into prominence. Whether Messrs. Ridsdale's effort will secure the unanimity they desire, or whether it will be ignored and pass into oblivion like previous efforts, cannot of course be predicted. It may, however, be suggested, apart from the merits of chemical standards in general, that such efforts in relation to steel at any rate have fewer chances of success nowadays than they had twenty or thirty years ago.

When cast steel was made only by the crucible process its quality and grade were determined by the brands of raw material used and the appearance of a fractured surface observed by the skilful eye of a trained man. In those days steelworks laboratories either did not exist or existed only in a very few works. When grades of hardness in steel classified by a skilled eye came to be expressed in percentages of carbon, and other constituents were likewise determined and expressed in concrete figures, the steelworks chemist shared with the steelmaker the responsibility not only of classifying material, but also of explaining why material which should have been right turned out in service to be wrong. The laboratory lived for a generation in a glamour which it never earned, and it left a legacy of misconceptions which still survive and will continue to live on for a generation or two.

Whereas the old craftsman depending on close observation and judgment could only suggest that defective tools had been overheated or burnt or spoiled in the forging, his new ally, or opponent, as the case might be, could say that the material contained 0·06% sulphur instead of 0·04% and was therefore red short, or 0·05% phosphorus instead of 0·03% and was therefore cold short. The expression of the cause of a defect in concrete figures had a magical effect. Now and again it could be shown that part of the carbon, for example in tool steel, had become graphitic and a correct explanation of an unexpected result could be given, but in most cases the explanations turned on the forlorn belief that the percentages of sulphur and phosphorus beyond the usual or specified limits were accountable for nearly every ill occurring in steel.

If one scans specifications for high-class steel material, their most notable chemical feature is that the sulphur and phosphorus shall not exceed 0·03%, 0·035%, or 0·04%. This feature is a direct heritage from the days when nearly all failures of materials were ascribed to chemical causes—mainly sulphur and phosphorus. Whilst it may not be argued that unrestricted amounts of sulphur and phosphorus confer any benefit on steel it is well known in these days that physical characteristics originating may be in the casting pit, in the forge or in the heat-treatment shop, are more vital in their effects on the reliability and suitability of materials than variations of 0·01 or 0·02% sulphur and phosphorus.

The advent of regular microscopic examination and what are called metallographic methods has caused a steady decline in the value of chemical analysis as a means of determining causes and effects. The old attitude is however adhered to in most British specifications, in some cases much to the detriment of national trade. Also it may

not be an easy task, and it will certainly not be a short one, to convince consulting engineers, to whom evidence comes indirectly, that the established limits of permissible sulphur and phosphorus have comparatively an imaginary value or an overrated value. It is so convenient to have a chemical basis of quality which can be appealed to at any moment during the life of the material that such a basis will be adhered to when its warranty no longer exists.

The bearing of these remarks on Mr. Ridsdale's paper lies in the fact that users are coming more and more to look upon steel as the embodiment of certain physical properties. In all structural work, of whatever grade, the designer counts on so much material withstanding so much stress. In terms of precise chemical composition he does not care whether this or that material of approved reliability is used. This seems to be a logical attitude and is likely to extend with the application of methods of heat treatment to wider classes of steel. The idea that the sum of certain chemical constants multiplied by certain factors can express reliably the physical properties of a steel is obsolete.

For materials such as ores, and alloys, the values of which are computable on a chemical basis, analysis is, no doubt, the proper means of valuation. For steels in general the chemical composition is fundamentally important to the steelmaker, but it may be of quite secondary importance to the steel user, and on that account labour spent on chemical standards may be less enthusiastically appreciated than formerly. The user will, no doubt, continue to be interested in the chemical composition of the steel he buys, and it is to be hoped that his specifications will indicate the class of material he wants. He should, however, regard the chemical clauses as an indication and not as a condition to be punctiliously enforced. In the light of present knowledge, the chemical clauses of a specification might be looked upon as a first line of defence against the delivery of unsuitable material. Material held up at this barrier may be no worse; it may be better; but the closer scrutiny of it will ease or tighten the conditions according to actual experience; in that way lies progress.

The writer is, on the whole, out of sympathy with Messrs. Ridsdale's efforts. Many of the proposals made are already being carried out. There are occasional differences relating to the composition of steel between buyers' and sellers' chemists, but they are not serious, and it is very rarely that such differences cannot be composed by friendly visits to each other's laboratories. The one aspect of chemical standards which may be permanently valuable lies in the confidence their use may inspire in the minds of operators who are not sure of themselves. An appeal to authorised standards may comfort such men.

Standard samples prepared by the works themselves have been in use for more than twenty years in some laboratories. Such standards may give comfort or bring confusion to an operator depending on whether or not he knows the standard has been issued to him. When issued without the operator's knowledge amongst ordinary routine work, the standards are, and have for a long time, been regarded as a useful check.

In the writer's opinion, the confidence of youths who are being trained as laboratory assistants should be strengthened by teaching them analytical methods on a synthetic plan. When they are able to determine an element in a sample of steel under the simplest conditions they should be encouraged to investigate for themselves the influence of interferences which may arise either from the presence of unusual elements in the steel or from the presence of impurities in the reagents. A man trained on these lines is perhaps not very respectful towards either statements or specimens issued under authority, but he is usually capable, if a mistake has occurred, of finding out how it originated and of taking precautions to avoid its repetition. However prevalent chemical standards may become and with whatever authority they may be issued, they are of limited value, and if reverenced overmuch, may weaken the most valuable characteristic of a reliable chemist, *i.e.*, the sense of confidence in his own work and the sense of responsibility for its actual accuracy.

CHEMISTRY AT THE INDIAN SCIENCE CONGRESS, 1919.

At the sixth annual Indian Science Congress held in Bombay, the presidential address was delivered by Lt.-Col. Sir Leonard Rogers, M.D., F.R.S., who chose for his subject the utility of the sciences of physiology, chemistry and physics in solving problems connected with the treatment of deadly diseases. This was the first occasion upon which medical science was included within the scope of the meetings.

Emetine and other alkaloids of ipecacuanha have proved of immense value in controlling amœbic dysentery and liver abscess, and the preparation of soluble salts of the unsaturated fatty acids of chaulmoogra and hydnocarpus oils, and of a similar preparation (sodium morrhuate) from cod-liver oil, have been used successfully in the treatment of leprosy and tuberculosis. Important results have been obtained by Capt. Shorten in his investigation of the vitamine-content of the Quetta sun-dried vegetables. Sir L. Rogers had frequently found that sodium antimony tartrate was safer and less irritating to the tissues than tartar emetic in the treatment of kala-azar, the mortality from which has been reduced from about 90 per cent. to nearly nil; and quite recently he had been using a colloidal antimony sulphide for kala-azar, and found it more effective and much less toxic than other antimony salts; there is hope that it may prove of great value in the treatment of sleeping sickness. Sir L. Rogers then sketched the history of the treatment of cholera. The mortality from this disease was initially reduced by using injections of isotonic salt solutions; when these were replaced by hypertonic solutions the mortality was further reduced by nearly one-half; and further notable reductions were effected by the use of permanganates to destroy the toxins in the bowel, and of sodium bicarbonate to combat fatal renal complications. The net effect of these discoveries—in which Col. Rogers played a notable part—was to reduce the mortality from cholera from 59 per cent. in 1895-1905 to 19·1 per cent. in 1915-17, while in 1917 it fell to 14·9 per cent. Such results prove the extreme value of scientific research, and indicate the urgent desirability of furnishing ways and means to extend it.

The following are brief abstracts of some of the chief papers read in the Section of Chemistry :—

Colloidal antimony preparations: by F. L. Usher.

Attempts were made to prepare stable solutions of metallic antimony for medical use. Chemical reduction methods invariably gave the metal as a precipitate; electric dispersion methods in organic media gave very unstable solutions except in the case of ethyl alcohol. Transference from alcohol to water, however, makes the solution unstable, even when air was excluded. Paal's protalbic acid method is inapplicable to antimony compounds. Solutions of the sulphide, 1 in 500, are now used; they are very stable when protected with gum arabic.

Note on an alkaloid in Argemone mexicana: by D. N. Chatterji.

Argemone mexicana, or prickly poppy [N.O. Papaveraceæ], is widely distributed in India. Opinions differ as to whether the seeds are poisonous; they may contain morphine, Dragendorff having obtained from them an alkaloid responding to morphine tests. The juice is not regarded as narcotic. The author obtained only a trace of alkaloid from the seeds, in the form of yellowish-white crystals, bitter, and alkaline. It differed from morphine in reactions, a characteristic test being the appearance of a violet colour followed by grey with a bluish-green tinge, and a sepia colour on heating, when a trace of nitric acid was added to a sulphuric acid solution of the alkaloid.

The purification of Indian sesame (til) oil: by H. Rai and H. B. Dunnicliff.

"Til" oil is used for soap manufacture, perfumes, margarine, and as an edible oil. Experiments were undertaken on decolorisation, deodorisation, hardening and bleaching, with the following results: (1) Bone charcoal and French chalk are the best decolorisers by filtration, but they do not deodorise. (2) Sunlight bleaches progressively, but does not deodorise. (3) Treatment with air improves colour, but does not deodorise. (4) Air and sunlight, combined, markedly affect colour, and leave the odour not unpleasant. (5) Sulphuric acid removes odour, and reduces colour very slightly. (6) Caustic soda is a good decolorising and deodorising agent. (7) The colour slowly returns to bleached samples. (8) The odour of deodorised samples is perceptible on heating, but not on cooling again.

Note on a new method of preparing nitrogen: by H. Rai.

Nitrogen, containing less than 0·2 per cent. of oxygen, can be prepared by the electrolysis of ammonium chloride solution in a cell with a porous diaphragm. It should be collected over caustic soda to absorb chlorine.

Salts of porphyroxin: by J. N. Rakshit.

An alkaloid, porphyroxin, has been isolated in a pure state from Indian opium, and various salts have been prepared and studied.

The resolution of the systems: nitric acid—sulphuric acid—water and nitric acid—water on an industrial scale: by G. S. Butler.

The theory of the process, a description and criticism of former processes, and an account of the author's work in the laboratory and on the large scale are given, leading up to the design of a large scale industrial plant.

An improved process and apparatus for obtaining on an industrial scale concentrated nitric acid from liquors in which this acid is present together with water: by G. S. Butler.

The process, based on the principles outlined in the former paper, is continuous, and is claimed to be the most economical and efficient existing method for obtaining concentrated nitric acid from mixtures of this acid with water and sulphuric acid.

The examination of the potash content of the ashes of Indian indigenous plants: by P. Neogi.

A list is given of Indian plants from the ashes of which potash has been obtained, together with the potash contents.

A note on the adsorptive power of coconut charcoal: by H. E. Watson.

The adsorptive power of charcoal was found to increase with the temperature at which it is made, *i.e.*, it increases as the quantity of volatile matter decreases.

The manufacture of glycerin by means of castor seed lipase: by J. J. Sudborough, H. E. Watson and P. S. Varma (v. this J., 1919, 5 R).

The authors are of the opinion that the method should be able to compete with the Twitchell process for the manufacture of glycerin and of free fatty acids for use in soap and candle-making.

MALT RESTRICTIONS AND THE VINEGAR INDUSTRY.

C. AINSWORTH MITCHELL.

The restrictions on the use of malt during the past year have affected the vinegar industry even to a greater extent than the brewing industry, for whereas the brewer has been able to produce a greater quantity of beer from his rationed material, the vinegar manufacturer has been precluded by the action of the Food and Drugs Act from altering his method of brewing. The allowance of malt to the vinegar manufacturer was fixed first at 75 per cent. and then at 50 per cent. of his usual consumption, and it is only recently that he has again been allowed to contract for the amount of malt required to meet his trade. Simultaneously with the decrease in the output of the manufactured article the stoppage of the sale of acetic acid put a temporary end to the production of the so-called "wood vinegar," and increased the demand for the brewed product. Hence, as soon as the manufacturers had used up their reserve stocks, there was a sudden shortage of vinegar, and it became necessary to ration the retailers, who, in a large number of cases, did not lose their opportunity of exacting a profit of several hundred per cent. upon the sale of an uncontrolled article to the public.

After the exhaustion of their stores of crude vinegar, the manufacturers were forced to send out a newly-made product, since there was no time to allow it to mature as under normal conditions; and this drawback was intensified by the difficulty of obtaining the malt which had been allotted to them. Hence vinegar which in ordinary times would not have left the works until three months after acetification had sometimes to be sent out within a fortnight after the malt had been received.

This omission of the usual period of storage has had several effects upon the vinegar. When crude vinegar is stored for a month or two in closed vats the acetic bacteria die, and the vinegar itself becomes more or less stable in composition, and acquires an aroma through the gradual combination of the acetic acid with traces of unconverted alcohol. Freshly-brewed vinegar, on the other hand, has very little aroma, and even though it has been rendered brilliant by filtration, soon becomes turbid and throws down a deposit, and, if exposed to even a restricted supply of air, will rapidly decrease in strength through the action of the acetic bacteria on the acetic acid. It is within the writer's experience that a crude vinegar may thus depreciate by as much as 0·5 in its percentage of acetic acid within the course of a day or two. Although there is no legal standard for the strength of vinegar the suggestion of the Local Government Board that vinegar shall contain not less than 4 per cent. of acetic acid is generally adopted, and most manufacturers send out their products at not less than 4·1 to 4·2 per cent. to allow for a slight possible depreciation in strength. In the absence of storage, however, it is not surprising that vinegar sent out at this strength should fall to 3·7 per cent. or less in acidity, through the action of the living bacteria supplied intermittently with air drawn into the cask through the spile hole. On these grounds there have been several prosecutions during the

past twelve months for the sale of vinegar containing less than 4 per cent. of acetic acid, but where it has been proved that the vinegar was originally sent out at or above that strength and that it has not been watered, the magistrates have usually held that only a technical offence has been committed.

Even now that the malt restrictions have been practically removed, it is difficult to obtain the malt to meet the present demand for vinegar, and many months must elapse before it will be possible for the manufacturers again to create a reserve store. Hence the conditions attending the sale of immature vinegar seem likely to continue for a considerable time to come. Of course sterilisation of the vinegar would obviate the principal drawback of the deterioration in the strength, but this course is not practicable in vinegar works dealing with thousands of gallons a day.

INAUGURATION OF THE CHEMICAL ENGINEERING GROUP.

The Inaugural meeting and dinner of the Chemical Engineering Group of the Society of Chemical Industry were held at the Liverpool Street Hotel, E.C., on March 21. Prof. J. W. Hinchley, Chairman of the Group, presided at the meeting.

Mr. F. H. Rogers, in his report, said that the Committee had estimated the current year's expenditure at £500, and that 382 members had now paid their subscriptions. Mr. H. Talbot reported that the Finance, Bureau of Information, and Standardisation Committees had been formed. The membership was at present made up as follows :—London, 143; Manchester, 43; Liverpool, 29; Edinburgh, 17; Nottingham, 30; Ireland, 6; Egypt, 1; Spain, 2; France, 3; Bristol, 22; Yorkshire, 34; Newcastle, 19; Glasgow, 20; Birmingham, 18; U.S.A., 4; South Africa, 3; and India, 1. Propaganda meetings had been held in Glasgow, Manchester, Liverpool and Nottingham, and one was shortly to be held in Birmingham. Both reports were put to the meeting and adopted. The draft rules were also adopted and the following were elected to the Committee :—Prof. J. W. Hinchley (chairman), E. A. Alliott, H. J. Bush, C. S. Garland, Capt. C. J. Goodwin, H. C. Greenwood, H. Griffiths, E. Hill, H. F. V. Little, A. J. Liversedge, Dr. W. R. Ormandy, J. A. Reavell, F. H. Rogers (Hon. Treas.), and H. Talbot (Hon. Sec.).

Prof. H. Louis, President of the Society, presided at the subsequent dinner. After the toast of "The King" had been duly honoured, the chairman proposed that of "His Majesty's Ministers." In doing so he expressed regret at the absence of Sir Auckland Geddes, owing to labour troubles, of Sir Albert Stanley (President of the Board of Trade), through illness, and of Sir Frank Heath.

In proposing "The Chemical Engineering Group," Prof. Louis said this toast was to have been in the hands of Dr. Charles Carpenter who, unfortunately, was indisposed. The Society of Chemical Industry, after long and very careful consideration, had decided that the formation of subject groups was one which deserved encouragement, and the Chemical Engineering Group was the first to be formed in that way. Personally he greatly rejoiced that he was president of the Society at the time this new departure was made, because chemical engineering had always had his keenest sympathies. He had a strong conviction that chemical engineering had very great possibilities. He did not think the war could have been brought to a successful issue but for the efforts of chemical engineers. Much of the work had been done by chemists who had no engineering training, but who had what he might call the average British aptitude for engineering. He felt confident that the combination of engineering and chemistry would lead to excellent results.

Prof. J. W. Hinchley, replying to the toast, said that the Group had only just come into being, and it had to justify its existence. There were many who were still unable to appreciate the existence of the chemical engineer, and there were many engineers to-day who would not agree that such a person existed. The Chemical Engineering Group was insisting on a special kind of training for the chemical engineer.

The toast of "Our Guests" was proposed by Mr. A. J. Liversedge, who coupled with it the names of the following speakers :—

Mr. Stanley Hicks said that the Salters Company, which had been in existence for 500 years, had recently resolved to march with the times and to establish the Salters Institute of Industrial Chemistry, but the available funds were not to be put into bricks and mortar. Fellowships were now being granted for 1, 2, 3 or 5 years to the best graduate of any recognised university or college with a view to helping these men to return to their colleges and continue their studies. Arrangements were also being made so that some of these men might gain practical experience with some of the large manufacturers.

Mr. Milne Watson spoke as a representative of the gas industry, and acknowledged the great debt which it owed to chemical science. To achieve success the workers in the gas industry must ally themselves with such bodies as the Society of Chemical Industry and the new Group, and cultivate a very close relationship with them.

Dr. E. F. Armstrong said that the future of the chemical industry both here and abroad depended very largely upon the application of engineering to chemistry. Unless engineers came to the rescue of industry, and especially the chemical industry, the outlook was a serious one. Among the great obstacles to chemical industry at the present time were high labour costs, dear and bad coal, and Government control. During the past few days he had been speaking to some of their colleagues who had been visiting the occupied territories of the Rhine, and who had seen the works put up by the great German chemical firms during the war. In England, owing largely to the facts that the chemist had never been interested in engineering and the engineering trades had taken precedence over everything else, the chemical industry came a very bad second in the race for any materials which it required. Those who had been to the Rhine reported that the German companies had never been stinted for a single thing, with the result that they had been able to build factories regardless of cost. In this country the industry had been strained to the utmost. Repairs had been allowed to go undone, depreciation had not been properly provided for, and temporary Government factories had been built which had done admirable work, but they were mostly constructed in a way which made them unsuitable for peaceful purposes, and they had been put down in places which made them totally unsuitable for ordinary methods of industry. He made no reflexion upon the policy of the Department of Explosives supply. German chemical engineers had still a good deal to teach us, and we must not run any risk of disparaging our German competitors in the future. He regarded the foundation of the Chemical Engineering Group as a portent of very great promise.

Mr. Frank Hemingway congratulated the Society on the formation of the Group and upon the fact that it was part of the parent Society. On

the other side of the Atlantic there were many societies pursuing the same end, and in consequence their efforts were somewhat diluted: it would have been better if they could have held together, as was being done in England.

Sir Alfred Keogh said that in his capacity as head of the Imperial College he had been acquainted with the importance of chemical engineering for many years. It was owing to their knowledge of its great importance that some few years before the war they started instruction in that subject. Unfortunately, owing to lack of funds they were unable to build a department worthy of it, but the matter was continually before the governors, and when the time came it was hoped to include in the new buildings a department of chemical engineering.

The final toast was that of "The Chairman," proposed by Mr. C. S. Garland, and responded to briefly by Prof. Louis.

NEWS FROM THE SECTIONS.

CANADIAN PACIFIC.

Owing to the prohibition of public meetings by the Provincial Board of Health, the first meeting of the Section in the present session was not held until December 14 last.

After the customary dinner at the University Club of Vancouver, an open discussion was held on "The Organisation of the Profession of Chemistry in Canada." Prof. McIntosh reported on the action taken at the Convention of Chemists, held last June at Ottawa under the auspices of the Canadian Section of the Society, by which a Chemists' Organising Committee was appointed. The progress which had been made in this work was indicated particularly with regard to the definition of a "chemist." Following this, the various British organisations of chemists and analysts were discussed and the progress made by the British Association of Chemists in negotiations with the Institute of Chemistry. In this regard it was pointed out that the Institute had no legal status in Canada although it doubtless had considerable moral or professional effect. It was concluded that no further action by the Section was in order, especially in view of the memorial presented by Mr. Berkeley, who represented the Section at the Convention in June.

On December 11, members of the Section attended a lecture under the auspices of the University Club of Vancouver, when Prof. D. McIntosh, of the University of British Columbia, gave a most interesting description of "War Gases." The development of those offensive materials was described, the method of manufacture, projection and absorption by masks. Compared with equal weights of explosives, it was shown that the various types of war gases had a very great advantage on account of their diffusive and penetrating properties and their effect in demoralising transportation and reducing *morale.* The quantity production of these gases in the United States was described, and also the development of new gases (in which research Prof McIntosh had been actively engaged). The possibilities of extending such barbarous methods of warfare to the extermination of whole armies made it necessary that chemists of the allied countries should not cease their investigations on this subject. Samples of the various substances used in filling shells and respirators were exhibited during the lecture.

NEW YORK.

At the January meeting, held at the Chemists' Club, the chairman, Mr. C. E. Sholes, announced that the arrangement made to hold joint meetings with the American Chemical Society during this session would be cancelled. Owing to the cessation of hostilities, the need for such an arrangement had now passed, and consequently the April meeting will be held as originally planned, and the Grasselli Medal will then be awarded. This medal has been founded by the well-known company whose name it bears, and is to be awarded each year for the best thesis which, in the opinion of the Committee, suggests or records the newest and best helps or accomplishments in applied chemistry.

As a part of the business of this meeting, and in view of the very great events which had happened since the last, the chairman had asked the vice-chairman, Dr. P. C. McIlhiney, to propose a congratulatory resolution to the parent Society. After some further remarks, the chairman called upon Mr. C. H. MacDowell, recently Chief of the Chemical Division of the War Industries Board, to address the members, after which Dr. C. F. Chandler, past-president of the Society, addressed Dr. C. F. Cottrell, of the Bureau of Mines, and presented to him the Perkin Medal for his distinguished work in the field of electrical precipitation. Dr. Chandler's speech, Dr. Cottrell's reply, and an appreciation of Dr. Cottrell's work on the de-emulsification of California oils by Mr. B. Speed will appear in the next issue of the Transactions.

LIVERPOOL.

A meeting was held on February 21 in the University to hear a paper by Mr. W. Clayton on "The Modern Conception of Emulsions." Mr. A. T. Smith was in the chair.

The author started with a brief account of the physico-chemical theory underlying the subject, *e.g.*, Willard Gibbs' mathematical relationships bearing on surface tension and adsorption at the interface of immiscible liquids, and the formulæ of Freundlich and Donnan. The electrical forces involved in the dispersion of an oil in a non-miscible medium so as to form an emulsion were then discussed, reference being made to Ellis's measurement of the potential difference (P.D.) between the oil globules and the continuous medium, *viz.*, about 0·05 volt, independent of the kind of oil used. This contact P.D. is intimately connected with the stability of an emulsion and can be decreased (and the stability diminished) by the addition of, say, mineral acid. Powis showed in 1914 that if the P.D. is decreased there is approached a critical value (about 0·03 volt) where an emulsion is most stable—and so the point of complete instability need not necessarily coincide with a zero potential, the so-called iso-electric point. Of the theories which have been advanced to explain the process of emulsification, those of Ostwald, Fischer, and the "Viscosity Theory" were discussed, and the work of Bancroft, Pickering, Briggs and Schmidt, Schlaepfer and others was referred to.

With regard to emulsion-formation in general, an emulsion of oil in water is produced if the emulsifying agent is a colloid soluble in water, or more easily wetted by water than oil, and an emulsion of water in oil is obtained when the emulsifying agent is an oil-soluble colloid or is more readily wetted by oil than water. In the investigation of emulsions the nephelometer and the drop-pipette or stalagmometer are useful instruments, and there are possibilities in research on the electrical conductivity, etc., of emulsions, in which direction little has been done hitherto.

MANCHESTER.

The adjourned discussion on the Chemical Engineering Group was resumed on March 1, with Mr. W. Thomson in the chair.

Dr. J. Grossmann, in a written communication, criticised the formation of the Group; in his opinion it might lead to disintegration, as membership would confer no special status unless a special charter were obtained. Under the conditions suggested, any workman or works foreman could set up as a chemical engineer. After a few remarks from Dr. R. B. Forster in support of the Group, Dr. W. R. Ormandy, replying to Dr. Grossmann, said that the new Group would confer no rights or title, being merely intended to enable its members to keep their knowledge up-to-date. If a workman had sufficient enterprise to join the Society and to attend the meetings of the Group, he would have a chance to attain a more important position in the profession. The tendency of the times was democratic, and it was necessary to democratise existing institutions. After a lengthy discussion, in which comparatively few members took part, the principle of the formation of the new Subject Group was approved by a large majority of those who voted.

In "A Note on a Deposit in Refined Soya Bean Oil," Mr. R. Brightman described an investigation into the nature of a white flocculent sediment which occasionally formed in the refined oil. The amount was very small but was sufficient to inhibit burning; after removal by filtration the burning power was restored, but in a diminished degree. By crystallisation from alcohol, a white neutral substance was obtained, which melted at 32° C., contained 7 per cent. of sulphur, and had a saponification value of 94·3. The experiments performed led to the conclusion that the deposit consisted of a complex sulphonated glyceride.

Mr. J. J. Bloch then contributed "A Note on the Reduction of the Nitrile Group," in which was recorded a number of experiments with benzyl cyanide and some of its derivatives. The yield of phenylethylamine by reduction of benzyl cyanide with sodium and alcohol was made very regular, at 35—40 per cent., by the addition of toluene. Attempts to obtain other reduction products from derivatives of benzyl cyanide proved unsuccessful.

EDINBURGH.

The Annual General Meeting was held on March 11, Mr. D. B. Dott presiding. The report on the work of the session (*v.i.*) was read, and Mr. J. Strachan then presented a paper on "The Origin of Errors in the Testing of Wood Pulp for Air-Dry Content."

After referring to the recent notable contributions to wood pulp testing by Lester (England) and Little (U.S.A.), the author stated that the adoption of official methods of sampling had not led to the uniformity of results expected. Errors are due to variations in distribution of moisture, and to variations in conditions of testing, the chief cause of the latter being inefficient methods of drying the samples. Specific errors in carrying out pulp tests are:—(1) Errors in selection of bales; (2) errors in drawing samples, in connexion with which the theory of pulp sampling as laid down by Lester, Griffin and Sindall was discussed and the mathematical reasons for varying the size of sample demonstrated by examples from actual practice; (3) errors in moisture estimation, which are mainly due to bad designs of drying ovens. The question of temperature of drying was fully discussed and a *résumé* given of the conflicting opinions of chemists in Europe and America. The error arising from drying at 100° C. until weight is constant may be quite appreciable, and in the case of badly designed ovens sometimes very large.

The second paper was by Mr. G. H. Gemmell on "The Duties of a Chemist in a Paper Mill." The author stated that, as a rule, the paper-maker does not employ a chemist, because he has no very clear idea of the kind of work he could give him to do. There are 55 paper mills in Scotland, and in 9 only of these are chemists employed. Six of the nine are in receipt of a weekly wage, having no control or responsibility for the working processes, and being entirely engaged in routine work in the laboratory. Why is this? One paper-maker is stated to have said that when he was making money he did not require a chemist, and when he was not, he could not afford one. This is where some think he was wrong. If he had had the right type of man when he was making money, he would have made more, and probably would never have been in the latter position. The range of work required from the chemist varies with the type of mill. In esparto mills, he should have control of the boiling, washing, evaporation, and causticising of the soda liquors, and in the laboratory should be able to make experimental boilings to determine the theoretical yield of fibre, the proportion of bleach required and the loss in bleaching; he should examine the lime sludge from the causticising kettles, the bleach sludge, and perform laboratory tests on the caustic bleach and alum liquors, etc. Dealing with the importance of checking wood pulp deliveries, the author stated that in 18 years his firm had sampled and tested for moisture 1806 deliveries, representing 159,182 tons of wood pulp. Of these, 1442 parcels were short weight, to the extent of 4442 tons, representing a money value of £71,300. It is strange, but true, that there are still paper mills in Scotland where the wood pulp is never tested. In others, the timekeeper, storekeeper, or office boy makes the test. The author then enumerated a number of other duties which should fall to the lot of a qualified paper-mill chemist, and concluded by asking, "Where can such a man be found?" Answer: he must grow and develop in the mill. The paper-maker should pick out some of his young men and give them facilities to obtain the necessary training.

Mr. Dott showed a specimen of sulphate of iron which had crystallised in stalactite form on the roof of one of the mines at Wallyford colliery (Midlothian). He found 95·5 per cent. calculated as $FeSO_4 7H_2O$. The remainder was mostly sodium sulphate with a small proportion of aluminium and magnesium sulphates.

The Hon. Secretary's report states that seven meetings were held during the session, and that the average attendance was 35. The informal meeting held in January was particularly successful, and it is proposed to have a similar meeting next session. Two interesting meetings were held at works, and the Section is greatly indebted to the managers of the North British Rubber Co., and of Messrs. Brunton's Research Laboratories, Musselburgh, for their hospitality. The invitations to attend the meetings extended to the members of the University Chemical Society met with a satisfactory response. The Committee urges the members of the Section to bring the meetings to the notice of the younger chemists of the district, and to give them a cordial invitation to be present.

The membership of the Section has increased during the past session from 111 to 136, an increase of 25; there are also several applications for membership at present before the Council. An appeal is again made to the members to do all in their power to increase the membership. Mr. D. B. Dott, who has been chairman of the Section for the last two years, retires by rotation at the end of the present session. The Section owes much to him for his

unfailing interest in its work. Four members of the Committee retire by rotation, *viz.*:—Messrs. J. G. Annan, J. Rutherford Hill, A. W. Sim, and Allan Smith.

It will be remembered that in February, 1918, the Section convened a meeting of chemists resident in Edinburgh and the East of Scotland, to consider the better organisation of the chemical profession. Arising out of this meeting, a local Section of the Institute of Chemistry was eventually formed in October, 1918. The work of this new society will not conflict in any way with that of this Section; on the contrary the Committee is fully confident that the best relations will obtain between the two, and that their mutual interests will be furthered by co-operating, when necessary. The new list of officers is as follows:—Chairman Dr. D. S. Jerdan, Vice-chairman Dr. H. E. Watt, Hon. Sec. and Treasurer Dr. A. Lauder. Committee: Mr. A. T. Adam, Dr. A. C. Cumming, Mr. A. M. Cameron, Mr. D. B. Dott, Prof. J. Hendrick, Mr. B. D. W. Luff, Mr. A. Middlemass, Mr. B. D. Porritt, Mr. J. W. Romanes, Mr. W. L. Thomson, Prof. J. Walker, Mr. A. W. Williams.

GLASGOW.

At the February meeting, Mr. J. Bibby presented a paper on some recent developments in the electro-metallurgy of iron and steel. Mr. Quintin Moore presided. After referring to the advantages possessed by the electric method of ore reduction, *viz.* the attainment of a much higher limit of temperature and the transference of heat energy to the material out of contact with oxidising gases, Mr. Bibby proceeded to describe the manufacture of pig iron by electric smelting, and to compare and contrast it with the ordinary blast furnace method. The electric furnaces are usually built in units of 4000 h.p. having a capacity of 1000 tons per month. The electric furnace is especially suitable for the refining of steel, since a reducing atmosphere can be maintained above the bath, but in order to ensure uniformity in the reactions it is essential to maintain a regular heat distribution over the bath. Four electrôdes are found to be sufficient for a 30-ton furnace.

MEETINGS OF OTHER SOCIETIES.

MANCHESTER LITERARY AND PHILOSOPHIC SOCIETY.

A paper entitled "The Post-graduate Training of the Works Chemist" was read by Mr. F. H. Carr, at the meeting held on March 4. The President, Mr. W. Thomson, was in the chair.

The author said that the comparative dearth in this country of highly competent technical chemists had frequently given rise to discussions, but these had as a rule been critical rather than constructive. He suggested that there was scope for Institutions devoted primarily to the post-graduate training of chemical students who intended to specialise in the applied aspects of their science. In such institutions, instruction would be given not only on a wide variety of technical processes for the manufacture of chemicals, and in operations in each technical department, from the drawing office and the power house to the special chemical plants, but also in the whole question of economic and statistical control of works processes. The chemicals produced should cover an extremely wide range, and should be such as might be required in relatively small quantities such as existing manufacturing firms would not find it worth while to produce. In this way the Institutions in question might, in course of time, accumulate stocks of chemicals comparable in variety with those in the possession of certain German firms on whose resources research chemists in all parts of the world have had to rely.

SOCIETY OF DYERS AND COLOURISTS.

The paper on "Effluents," read by Dr. H. T. Calvert to the West Riding Section on March 6, was mainly concerned with waste liquors from the textile trades. To these trades (which in 1913 produced goods valued at £400,000,000) the question of water supply is of very great importance. Local supplies are becoming exhausted, and further supplies, if available, will have to be brought from a distance; so that quite apart from the increased cost of labour and materials, the manufacturer will have to pay more for his water. In the use of water for manufacturing purposes there are many opportunities for conservation, either by restricting the use, or by re-using water for more than one process with or without an intermediate purification.

At the present time about half the manufacturers in the country discharge their effluents into the public sewers, and it is very desirable that legislation applicable to the whole country should be passed at an early date, in order that manufacturers may make terms with the local authority for the reception of their effluents.

Dr. Calvert then suggested a number of lines of research in the recovery of by-products from effluents, and expressed regret that no serious attempt had been made during the war to recover potash from wool scourings. The trade processes which give rise to polluting liquids in the textile industry may be divided into those in which the raw materials are prepared for further operations by the removal of naturally adhering substances, and those in which the semi-manufactured goods are finished or dyed. The effluents from the former class contain as a rule much more organic matter than those from the latter, and the method of purification has to be selected in accordance with this fact. In all cases it is necessary to remove suspended solids and to neutralise the effluent before it undergoes further treatment by, preferably, filtration through biological filters. A plea was made for a more scientific consideration of sedimentation problems with regard to the removal of suspended solids.

Whereas the biological method has been applied mainly in the purification of domestic sewage, chemical treatment by water-softening has been the rule in the purifying of trade wastes. In both cases efforts have been made, with some success, to economise space in the construction of plant on limited sites. Further progress will be effected when manufacturers come to regard effluent treatment as one of their manufacturing processes, and to realise that such treatment, even if apparently unproductive, may be economical by allowing of the use of river water instead of towns' water.

THE CERAMIC SOCIETY.

At a meeting held on March 10, at Stoke, Dr. J. W. Mellor contributed "A Note on Blue Glass." In the early days of Zeppelin raids, there was a demand for a blue glass for lamp bulbs. Nothing seemed simpler than to colour the glass with a little cobalt oxide, but it was found that the incandescent filament appeared red through this coloured glass, and to a short-sighted person the lamp seemed to glow with a red light surrounded by a blue halo. It was therefore desired to cut out the red rays.

The ordinary use of blue in the laundry, and the similar application by potters of blue stain (made with cobalt oxide) to correct the creamy tint caused by iron oxide in their white bodies, suggested that the introduction of a green-colouring oxide into the glass might serve to cut out or mask the complementary red. Copper oxide was first tried, but failed to cut out all the red; a small proportion of chromic oxide with the cobalt oxide, however, proved perfectly satisfactory, giving a glass which transmitted nothing but blue rays.

Photographs of the absorption spectra of the various glasses showed their effects on the light.

The staining mixtures for the glass were composed of 20 parts copper oxide to 80, 40, 20, 10, and 5 cobalt oxide, the percentages used as stain being 2·5, 3, 4, 3, and 5 respectively. Also 20 parts chromic oxide to 200, 150, 60, 25, and 10 cobalt oxide, the percentages used as stain being 2·2, 1·7, 1·2, 0·9, and 0·6 respectively. The percentages used of the separate oxides were 4, 2, and 0·4 for copper oxide, cobalt oxide, and chromium oxide respectively.

The glasses were annealed and then ground down to plates of 0·5 mm. thickness. The spark spectrum of nickel (in air) was used as a standard, and each exposure was for thirty seconds.

In passing it was noticed that in the cure of the chromic oxide with cobalt oxide glasses, a tint approaching ruby red was sometimes developed.

A paper on "Pottery on the West Coast of Africa" was read by Mr. D. Roberts.

ROYAL SOCIETY OF ARTS.

At a meeting held on March 5, Prof. Wyndham R. Dunstan in the chair, a paper entitled "The Rubber Industry, Past and Present" was read by Mr. B. D. Porritt, chief chemist to the North British Rubber Co., Ltd., Edinburgh.

The first extensive use to which rubber was put was in making waterproof cloth, and this branch of the industry received a great impetus at the time when the making of coal gas began to be carried out on a large scale. Little further progress was made until 1840 when Goodyear in America made the discovery of "vulcanisation." The details of the process were kept secret, but Hancock, working in this country, succeeded in 1843 in reproducing the necessary conditions after a long series of experiments. Although Goodyear was undoubtedly the first to produce articles of vulcanised rubber, Hancock must be regarded as the "Father of the Rubber Industry," as his early work supplied us with the essential processes of milling, compounding, moulding and spreading rubber.

The development of the industry progressed rapidly at this period, but for the past sixty years no fundamental improvements have been effected in manufacturing operations. Enormous changes have, however, taken place in the character of the industry. Hancock was probably the first to suggest the possibility of cultivating caoutchouc-bearing plants, a project to which he drew attention in 1855. This was subsequently realised as a result of the enterprise of Wickham to whom the plantation industry largely owes its inception. It is as producer and not as manufacturer that Britain now retains a predominant place in the rubber world, 70 to 80 per cent. of the world's supply being now produced within the Empire.

Turning to manufacture, the lecturer pointed out that whereas in ten years the United States had increased its consumption of crude rubber from 24,000 to 177,000 tons, Great Britain, the next largest manufacturer, increased hers from 14,000 to 26,000 tons. If the British manufacturer is to compete successfully with his rivals in the world's markets the practical man of the early days must be supplemented by the modern trained specialist. The data necessary for developing factory control, evolving new processes of manufacture and devising fresh applications for rubber, can be obtained only by systematic and careful research into the chemical and physical properties of caoutchouc and other colloids.

In spite of the enormous amount of attention given to the problem of synthetic rubber during recent years, a satisfactory substitute has not yet been produced. Nevertheless, the rubber trade might well contemplate the future and decide whether the risks incidental to existing conditions are sufficient to justify, on commercial and national grounds, the cost of an investigation into the synthesis of rubber.

In his paper on "The Distribution of Heat, Light and Motive Power by Gas and Electricity," read on March 19, Sir Dugald Clerk dealt with the relative efficiency of gas and electricity with special reference to coal conservation. About 20 million tons of coal of an average calorific power of 13,000 B.Th.U. are carbonised yearly by the gas industry, and the average thermal efficiency, when all the products are burnt, is about 71 per cent., 25 per cent. of this being attributed to the coke and tar. If the whole of the 29 per cent. of heat lost in gasification is debited to the gas, the thermal efficiency of the gas-making process is reduced to 46 per cent. The electrical industry generated 4674 million units in the year ending March 31, 1918, from 7·3 million tons of coal of calorific power 11,600 B.Th.U. The amount of heat obtainable from the current produced was 8·5 per cent. of the heat of the coal. Hence the relative efficiency of gas and electricity was 46 : 8·5 = 5·4 : 1. Allowing for unutilised heat in gas fires, the relative efficiency becomes 4 : 1.

The inverted incandescent gas lamp requires 47 B.Th.U. for each candle-power-hour obtained by the consumer, the 1-watt electric lamp requires 54 B.Th.U. and the ½-watt lamp 31 B.Th.U.; but the high pressure incandescent gas lamp requires only 23 B.Th.U., and the electric arc lamps only 15 B.Th.U. Thus there must be keen competition between gas and electricity for lighting purposes. As regards power, an ordinary gas engine working at 75 per cent. of full load will deliver, in actual horse-power, 11 per cent. of the heat used at the gas works; an electric motor will give 6·8 per cent. of the heat used at the electric generating station. Therefore the relative efficiency of production and distribution in this case is about 1·6 : 1.

With regard to the proposed establishment of electric super-stations, the author pointed out that the anticipated efficiency of 19·6 per cent. was 2·3 times greater than that actually achieved, on the average, in the past. But the gas industry also anticipated great improvements, and in the near future expected to attain an efficiency in gas production of 75 per cent., and of 93 per cent. in distribution. Assuming the distribution of coal gas generated to be 55 per cent. for heating, 35 per cent. for lighting and 10 per cent. for motive power, the substitution of electricity, generated at existing power stations for all three purposes, would involve the consumption of 2·65 times as much coal; and even if the anticipated efficiency of the super-power stations were attained, and no improvements were effected in gas production, the coal consumption would still be 1·91 times greater. The use of electricity as the sole source of heat, light and power would be fatal to the prosperity of the country. There was plenty of scope for electricity for special purposes, and it could not be dispensed with. All coal should be carbonised before combustion, whether for domestic or industrial purposes; and where the conditions permitted, as in the case of municipalities, gas and electricity

should be generated at the same works so that waste heat could be utilised, and the coke employed in adapted steam-boiler furnaces for the production of electricity and for other purposes.

INSTITUTE OF CHEMISTRY.

The London and South-Eastern Section of the Institute of Chemistry was formed at a meeting held at 30, Russell Square on March 14.

Sir Herbert Jackson, President, in opening the proceedings, said that the Local Sections already formed had demonstrated their usefulness and were taking an active part in assisting the Council in promoting the interests of the profession of chemistry. The Council desired that Local Sections should have a free hand in the conduct of their business.

Dr. Bernard Dyer having been elected to the Chair, the Section was declared duly formed. A Committee was elected as follows:—Mr. C. T. Abell, Dr. O. L. Brady, Mr. A. J. Chapman, Miss E. M. Chatt, Dr. Bernard Dyer, Mr. A. V. Elsden, Mr. Norman Evers, Mr. J. A. Gardner, Mr. C. S. Garland, Dr. W. H. Gibson, Mr. W. H. Harrison, Mr. E. M. Hawkins, Prof. J. W. Hinchley, Prof. P. H. Kirkaldy, Mr. F. H. Lees, Mr. T. Macara, Mr. W. A. C. Newman, Mr. F. M. Potter, Mr. F. M. Ray, and Mr. J. Miln Thomson. Mr. W. Bacon was appointed Hon. Secretary, *pro tem.*

The draft rules for Local Sections were provisionally adopted and a general discussion ensued on the proposed revision of the bye-laws for the election of the Council of the Institute.

At a meeting of Fellows and Associates held recently at Newcastle-upon-Tyne, it was decided to form a Local Section. Prof. P. Phillips Bedson presided, and the Registrar of the Institute was also present. A Committee was appointed consisting of Prof. Bedson, Dr. J. T. Dunn, Prof. H. Louis, Mr. R. A. Moore, Mr. C. H. Ridsdale, and Mr. Thomas Wallace. The Committee was empowered to add three to its number, and Dr. Dunn was appointed Hon. Secretary, *pro tem.*

INSTITUTION OF MINING AND METALLURGY.

"The Volatisation of Gold" was the subject of a paper read before this Institute by Sir T. K. Rose on March 20. The results of the investigation showed that at the temperatures of industrial melting furnaces, 1000°—1300° C., the volatisation of gold, even in a strong draught, is so exceedingly small that it cannot be measured with accuracy. All alloys of gold with silver or copper suffer appreciable loss through this cause unless they are protected with a cover of slag. The loss is due to the ejection of very minute globules of the alloys when the occluded gases leave the molten material. Those alloys which when molten take up oxygen, spirt or effervesce when placed in a reducing atmosphere; those which occlude hydrogen, or carbon monoxide, behave similarly in an oxidising atmosphere. Fine silver and its alloys with copper also spirt freely.

THE SALTER'S INSTITUTE OF INDUSTRIAL CHEMISTRY.—Post-graduate fellowships have been awarded to the undermentioned students of chemistry whose training has been interrupted by war service. Their studies will be pursued at the universities or colleges indicated: W. H. Gough, B.Sc., and W. A. Haward, B.Sc. (Imperial College), Capt. L. J. Hudleston, B.Sc. (Reading University College), Lieut. K. H. Saunders and G. M. Wright, B.Sc. (Cambridge University), P. N. Williams, B.Sc. (Liverpool University), and Lieut. D. C. Vining (Finsbury Technical College).

NEWS AND NOTES.

CANADA.

Maple Sugar and Syrup.—The Canadian maple sugar and syrup crop of 1919 should be a good one. Dealers report many inquiries by the export trade, and prices will be profitable. Only 50 per cent. of the sugar maples in the average sugar bush are tapped for a crop of sugar and syrup each spring. Prices have been high during recent years, and the demand has been greater than the supply. There are prospects of large orders from France, where the sugar has been introduced by Canadian soldiers and a taste for it acquired.

The eastern townships of Quebec form the centre of the world's supply of maple products. The acreage under maple in Canada is 550,000, of which two-thirds is in Quebec. The number of producers of maple sugar and syrup in Canada is stated to be about 45,000 (see this J., 1918, 277 R).

Pulp and Paper.—The Canadian Bureau of Statistics places the total capital invested in the pulp and paper industry in the Dominion, including land, buildings, machinery, stocks on hand and "working" capital, at £37,274,981 for 80 companies, 31 of which are engaged in the manufacture of pulp only, 20 in the manufacture of paper only, and 23 in both pulp and paper production. The aggregate value of production in 1917 was £19,249,764.

The technical section of the Canada Pulp and Paper Association has organised an educational campaign for its workmen, and text books are being prepared. The sum of $30,000 has been subscribed by the paper industries in Canada and the North Eastern part of the United States for the purpose of developing technical education among the employees. In this way it is hoped to facilitate the provision of a greater number of workers capable of directing large scale plant and mill operations.

Engineering Institute of Canada.—The annual meeting of the Engineering Institute of Canada was held at Ottawa from February 11—15. The president-elect, Lieut.-Col. R. W. Leonard, is also president of the Coniagas Reduction Company, one of the largest producers of refined silver in Canada. Some four hundred members were present and various engineering topics were discussed, such as highway engineering, tunnelling, electrification of railways, and production of Cobalt silver ores. Both Provincial and Dominion Governments are preparing to spend large sums on national highways, and this particular branch of engineering will be very important in Canada for many years to come. In his address, Lieut.-Col. Leonard stated that there were three companies in Ontario engaged in the smelting and refining of Cobalt ores. Formerly the refining was carried out abroad, but this policy is found to be very detrimental to Canadian industries, and now most of the cobalt used in the world is made in the Canadian works by reduction of the oxide with carbon and melting the metal in an electric furnace. The cost of mining, milling and refining the fine silver produced in 1918 by the Coniagas Co. amounted to 41·35 cents per ounce.

AUSTRALIA.

Tasmanian Iron Ore Deposits.—The Australian Federal Government has acquired a twelve months' option over the Blyth River iron ore deposits in Tasmania. The price asked by the present owner is £110,000 in cash, or £60,000 cash and one-twentieth interest in any company to be formed, the capital of such company to be not less than £1,000,000.—(*Iron and Coal Tr. Rev., Mar.* 7, 1919.)

Coal Discovery in Queensland.—It is reported from Queensland that coal has been discovered on a large area of land held by the State on the Styx River, between Rockhampton and Mackay, and boring operations have disclosed a seam 5 ft. 6 in. thick. When the railway to Mackay has been completed, the new coalfield will be linked up with the northern sugar area, and supplies of coal will be of great importance to the nine sugar mills operating in that district. Shaft sinking has been started.—(*Iron and Coal Tr. Rev., Mar.* 7, 1919.)

SOUTH AFRICA.

Science and Industry in South Africa.—The Minister of Mines and Industries has approved of an amalgamation of the Industries Advisory Board and the Scientific and Technical Committee. The amalgamated body will be known as the Advisory Board of Industry and Science. The Minister has been pleased also to approve of the following nominations: Mr. C. G. Smith, chairman of the Industries Advisory Board, as chairman; Mr. Bernard Price, chairman of the Scientific and Technical Committee, as deputy chairman; and Mr. E. Chappell, vice-chairman of the Industries Advisory Board, as deputy-chairman.—(*Official.*)

Van Rhynsdorp Marble Deposits.—A report has been received from the Inspector of Mines, Cape and Free State Inspectorate, respecting a marble proposition which has been opened up in the Van Rhynsdorp district of the Cape Province, and which is about to be exploited on a commercial scale. The deposit contains large reserves of marble, which are readily accessible and easily mined; and the mineral is said to cut and polish splendidly. The company which is to develop the proposition has already bought cutting and polishing machinery, and is preparing to transport it from Johannesburg to the property.

The Salt Industry.—During the last five or six years the salt industry has made such strides that the local production is now sufficient to meet all demands, besides leaving a small margin for export. In 1913, the Union imported 11,364 tons of salt (including 1210 tons of rock salt), whereas in 1917 the imports had fallen to 2556 tons. On the other hand, exports during the same period rose from 47 tons to 3025 tons The latter figures refer to coarse and table salt only, as rock salt does not occur in the Union, although there appears to be no reason why artificially prepared rock salt should not be produced locally at a price equal to that of the imported article. The total production of salt of all kinds in the Union increased from 47,992 tons in 1913 to 57,984 tons in 1917.—(*S. Afr. J. Ind., Dec.,* 1918.)

The Steel Industry.—In the Government Mining Engineer's Report for 1917 reference is made to the present position of the Union's steel industry. At the Union Steel Corporation's works at Vereeniging, rails, bars, angles, skip wheels, loco wheels, cast steel pistons for the South African Railways, and steel castings for hydraulic presses for baling wattle bark, etc., are being produced. The chief items of plant are a 10—12 ton Siemens gas-fired open hearth furnace, a 20-ton Siemens regenerative furnace, a 22-in. cogger complete with producers and steam-raising plant, a gas-fired regenerative furnace for the cogger, and a complete nut and bolt making plant for sizes up to 1½ in. diameter. Two 3½-ton Héroult electric furnaces are to be installed for the purpose of carrying out a contract for 10,000 shoes and dies for the mines, but they will also be capable of producing the highest grades of tool steel, etc. Steel castings up to 5 tons weight have been produced, and to meet exceptional circumstances castings up to 10 tons could be dealt with.—(*Official.*)

BRITISH INDIA.

Cinchona Cultivation in Bengal.—The output of quinine from the Indian factories for the three years 1916—18 is stated to be 192,000 lb., an average of 64,000 lb. per annum. The Indian plantations appear to be increasing their output, the figure for the year 1917—18 being 618,073 lb., and owing to the fact that the consumption of the quinine factories was only 654,093 lb., the amount of imported bark so used has shrunk from about one-third of the total consumption (as in former years) to quite a small percentage of the whole; and the country would appear to be very nearly able to supply the factories with their full requirements. The bark harvested is apparently of fair quality although not up to the standard of the average shipments from Java. The average percentage of quinine sulphate is given as 4·53, and from the production of other alkaloids for the year, one may deduce that the bark also contained, approximately, cinchonidine and cinchonine sulphate 2·0 per cent., quinidine sulphate 0·2 per cent., and amorphous alkaloid as sulphate 0·2 per cent. A considerable proportion of the factory output is in the form of febrifuge, 8518 lb. having been produced, as compared with a total output of quinine sulphate of 29,417 lb. This febrifuge contains presumably the bulk of the cinchonine present in the bark with small proportions of the remaining alkaloids.

The average cost of the bark is given as \$·05—\$·07 per lb., which would make the cost per unit of quinine in bark (assuming that the average test given above is correct) about 0·66*d*. As regards manufactured quinine the cost of extraction is given as \$1·06 per lb., bringing the total cost of the quinine sulphate produced by the Indian Government to \$2·40 per lb. The Indian Government was therefore able to distribute quinine sulphate at a cost of about 7¼*d*. per oz., while the lowest market rate during the period was 2*s*. 4½*d*.—(*U.S. Com. Rep., Jan.* 28, 1919.)

Government Ironworks in Mysore.—A Government ironworks is to be erected at Benkipur, Mysore. The scheme will be entirely financed by the Mysore Government, and its management placed under the control of a board of three representatives of the Government and two of the Tata Iron and Steel Co., which will manufacture pig-iron for the Mysore Government.—(*Iron and Coal Tr. Rev., Mar.* 7, 1919.)

Mineral Output in 1917.—The notable increase of over 34 per cent. in the production of chrome ore was mainly due to the operations in Baluchistan and Singhbhum. The latter locality also contributed a very great increase in copper—20,108 tons as against 2173 tons in 1916. It is hoped that the smelting operations of the Cape Copper Co. will add further to the production of this metal. The Tata Iron and Steel Co. produced 167,870 tons of pig iron, and 114,027 tons of steel, including steel rails; whilst the Bengal Iron and Steel Co. produced 80,262 tons of pig iron and 2256 tons of cast-iron castings. The production of jadeite increased from 3783 cwt. to 3961 cwt. There was a very large increase in the output of lead from the Bawdwin mines, *viz.*, 71,000 tons in 1917 against 14,000 tons in 1916. The value of the salt production was £983,157, as compared with £728,358 in the previous year. Of the rarer ores, the output of molybdenite rose from 202 tons to 626 tons; and the 20 per cent. increase in the output of wolfram was contributed to by the Rajputana States, where, however, operations are limited by the scarcity of water. (See also this J., 1919, 8 R.)

UNITED STATES.

Change Over Plans and Activities.—The United States Government is said to have about $300,000,000 invested in chemical plants, and that it intends to dispose of some of these establishments at an early date. No decision has been made with reference to the future of the nitrate plants in which at least $75,000,000 is invested. A fairly adequate idea of what is involved in getting the American chemical industry upon a sound peace foundation may be obtained from a recent offer by one firm to sell its war plant costing $100,000,000 for a mere $6,000,000.

The great plant, costing $6,000,000, established in California to work upon kelp has been closed down. The primary product of this plant was acetone and not potash, as some think, and it is the property of a powder company which used all the acetone for its own purposes. Investigations upon solvents of other kinds, and upon a variety of kelp products, are being continued, some of the work being still upon a laboratory scale.

The Government is interesting itself in the permanency of the American potash industry and the Secretary of the Interior is interested in a Bill recently introduced with that object.

Now that toluol and other needed raw materials are plentiful the dye manufacturers are paying more attention to needed vat colours. At least three can now be obtained, including indigo, in ample quantity.

Solvent Recovery.—The solvent recovery plant now being installed by one of the great rubber companies is designed upon new lines and is calculated to save about 20,000 gallons a month. One of the novel features involves immersing an entire pump in a bath of oil in order to control the temperature and prevent undesirable condensation of vapours at that point.

Burnt Clay for Gravel in Concrete.—At one of the Southern shipyards no gravel for concrete ships was to be had, and the method adopted to remedy the deficiency has aroused some interest. The native clay was fired at the correct speed and temperature in a rotary kiln, and the resulting hard, porous lumps of the right size made a strong concrete more buoyant than the usual material. The resulting ships are of higher rating with respect to carrying capacity than those of ordinary concrete or wood, and nearly equal to steel ships.

Work of the Bureau of Mines.—During 1918 the Bureau of Mines devoted almost its entire efforts to war purposes. Perhaps its most notable achievement was the development of a great laboratory in Washington for the study of gases used in warfare. Starting with a small nucleus of men, about fifty in number, who had been engaged in the study of mine gases, the chemical staff had grown to 1700 by the end of 1918. The Bureau also contributed to the development of an efficient mine-rescue breathing apparatus, carried out numerous tests on explosives and acted as a central source of technical information on the subject of fuel conservation, advising the U.S. Fuel Administration in this connexion.—(*Coal Age, Jan.* 1919.)

GENERAL.

British Association for the Advancement of Science.—The annual meeting will be held at Bournemouth from September 9 to 13, under the presidency of the Hon. Sir Charles Parsons. The last meeting was held at Newcastle-on-Tyne in 1916, and it was intended to hold the 1917 meeting at Bournemouth and the 1918 meeting at Cardiff, but owing to difficulties created by the war these meetings had to be abandoned.

L'Entente Chimique.—A very important meeting of chemists is to be held in Paris during the week preceding Easter. The chemists of France are about to form a national federation of chemical societies, which will include the following representative bodies:—La Société Chimique en France, La Société de Chimie Industrielle, L'Association des Chimistes de Sucrerie et de Distillerie, La Société des Experts Chimistes, L'Association des Chimistes de l'Industrie Textile. The proposed federation will have similar objects to those of our Federal Council for Pure and Applied Chemistry, and advantage will be taken of the presence at the meeting of representatives from England, the United States, and Italy to discuss the formation of an Inter-Allied Federation of Chemical Societies. The Federal Council for Pure and Applied Chemistry will be represented by its chairman, Sir William J. Pope, K.B.E., and by Mr. A. Chaston Chapman, past-president of the Society of Public Analysts. Prof. H. Louis and Dr. C. A. Keane have accepted invitations to be present, and, in addition, the Society of Chemical Industry will also be represented by Mr. W. F. Reid and Dr. S. Miall. The provisional programme is as follows:—April 14: Reception of the President of the Society of Chemical Industry. April 15: Meeting to consider the formation of an Inter-Allied Federation of Chemical Societies. Conference to discuss the question of an international organisation for the preparation of chemical abstracts. April 16: The representatives will journey to Mulhouse to visit the Alsatian potash deposits. In addition, the proceedings will also include an address by Prof. Louis, and a banquet will be held under the presidency of one of the French Ministers.

British Association Fuel Economy Committee.—This Committee, which was originally appointed in 1915 and issued its first report in 1916, has, owing to the urgency and importance of the coal situation, been reappointed to continue its investigations upon the various economic, scientific, and technical issues connected with the production and utilisation of coal and other fuels.

Prof. W. A. Bone has been reappointed chairman, with Mr. H. J. Yates vice-chairman and Mr. R. L. Mond as secretary. The General Committee of 33 members includes representatives of the Association of British Chemical Manufacturers, Coke-Oven Managers' Association, Federation of British Industries, Institution of Electrical Engineers, Institution of Gas Engineers, Institution of Mechanical Engineers, Institution of Mining and Metallurgy, Institution of Mining Engineers, Iron and Steel Institute, Society of British Gas Industries, and the Society of Chemical Industry. It is divided into three sub-committees:—(A) Chemical, General, and Statistical, presided over by Prof. H. Louis, with Prof. W. W. Watts as vice-chairman. (B) Carbonisation and Metallurgical, presided over by Sir R. Hadfield, Bart., with Mr. A. Hutchinson as vice-chairman; and (C) Power, presided over by Mr. C. H. Wordingham, with Mr. W. H. Patchell as vice-chairman. The Executive Committee, which consists of Sir R. Hadfield, Sir J. Walton, Professors W. A. Bone, H. Louis, and W. W. Watts, Dr. H. S. Hele-Shaw, Messrs. A. Hutchinson, R. Mond, W. H. Patchell, H. Woodall, C. H. Wordingham, and H. J. Yates, meets in London on the second Wednesday in each month. The Committee is now compiling data and information concerning a number of subjects of public interest, including such questions as:—(1) The economic aspects of coal production in Great Britain, (2) low temperature distillation of coal, (3) future standards for public gas supplies, and (4) the pro-

posed Electric Power Scheme, etc., and invites individuals, firms, or institutions to place at its disposal any valuable information they may possess.

All communications should be addressed to Prof. W. A. Bone, F.R.S., at the Imperial College of Science and Technology, South Kensington.

Ammonium Nitrate as a Fertiliser.—The Board of Agriculture draws the attention of farmers to the fact that large quantities of ammonium nitrate are now available. Hitherto the disadvantage of this material for manurial purposes lay in the readiness with which it absorbed moisture from the air, sometimes setting into solid lumps which made it difficult to drill into the land. This defect has, however, been overcome, and the material now at disposal may be stored for a considerable period without absorbing moisture, and remains in good condition and quite suitable for drilling. Experiments made recently at Rothamsted (J. Board Agric., Feb., 1919) show that ammonium nitrate is more effective than ammonium sulphate for mangolds and wheat, when applied on an equal nitrogen basis. Its use for potatoes is considered more risky, as although it gave as large a crop, it induced a large growth of haulm, which would be a disadvantage in a season of blight. It will be remembered that Prof. J. Hendrick obtained equally satisfactory results with ammonium nitrate for hay and oats (this J., 1918, 146 R). Some of the material now purchasable may contain TNT, but provided the amount of this does not exceed 1 per cent. it may be regarded as harmless. The Disposal Board is prepared to issue ammonium nitrate at £25 per ton f.o.r. store, packages free, and buyers should apply to the Secretary, Disposal Board (D.B. 4C), Ministry of Munitions, Storey's Gate, S.W. 1, stating that the material is required for use as fertiliser.

Newfoundland Cod Liver Oil.—The Imperial Institute has recently been investigating the medicinal value of cod liver oil from Newfoundland. Thirty tuberculous patients in a London hospital were given this oil in place of the Norwegian product for a period of three weeks, with the result that no difference could be distinguished between the two oils. The results are considered to be very satisfactory, and there appears to be no reason why the Newfoundland oil should not find an increasing market in this country. Excessive shipping freights have recently been a serious handicap; the freight per gallon was approximately 3*s*., compared with 6*d*. during 1914-17, and about 2*d*. in normal times.

Margarine Production in the United Kingdom.—Since the outbreak of war the production of margarine in Great Britain has increased almost tenfold. The maximum output before the war was 1000 tons per week and to-day the output varies from 7000 to 8000 tons. Raw materials are mainly obtained from West Africa, Nigeria and India. In the year before the war the total exports of palm kernels from West Africa amounted to 250,000 tons, valued at over £4,000,000, together with 100,000 tons of palm oil and palm kernel oil valued at £2,000,000. It is estimated that not more than one-tenth of the West African harvest is gathered, the remainder being allowed to rot on the trees. This source alone would amply repay commercial exploitation. —(*Manch. Guard., Mar.* 7, 1919.)

German Dyeworks under French Control.—According to a Berlin telegram, the Höchst dyeworks have not been sequestrated, but merely put under the supervision of two French chemists. The work goes on unhindered. Both stocks and newly manufactured chemicals are to be used in the first place for the Allies; the remainder to be exported to the unoccupied part of Germany, subject to the approval of the French authorities. Adequate stocks of salvarsan are still available. According to a Höchst telegram, the French officials in occupation are having all the business books of the Höchst Dyeworks examined and copies made from them, particular attention being paid to the books describing foreign clients. The entire export of the dyeworks is subject to enemy supervision.—(*Rhein. Westfäl. Z., Feb.* 12, 1919.)

The French garrison in Höchst has taken possession of the local dye works. A large number of French chemists are working with the German employees, and the results, particularly those relating to dyes and salvarsan, are transmitted to the Allied countries. The exportation of salvarsan into Germany has been rigorously prohibited, and in consequence a serious shortage of this medicament has arisen in the German hospitals and nursing homes.

The Badische Anilin- u. Sodafabrik at Ludwigshafen has called an extraordinary meeting for March 1, with the object of raising a further 50 million marks of capital at 4½ per cent. The money is to be devoted in the first instance to the extension of the ammonia works in Leuna near Merseburg. No financial assistance from the State is to be expected under present conditions.—(*Z. angew. Chem., Feb.* 14, 1919.)

Proposed Nitrate Production in Denmark.—According to the *Berlingske Tidende*, the urgent need of providing Denmark with fertilisers and rendering her independent of other countries has been engaging serious attention. Experiments are to be undertaken to initiate an artificial nitrate industry, for which the State has promised 20,000 kr., to be spread over 3 years, and the Danish Fertilisers Company 80,000 kr. for the purpose of erecting an experimental factory. The preparatory experiments are to be undertaken in the Polytechnic at Copenhagen under the direction of Professors Raaschow and Meyer (krone = 1*s*. 1½*d*.).—(*Z. angew. Chem., Jan.* 3, 1919.)

Artificial Fertilisers in Holland.—An idea of the insufficiency of the quantities of fertilisers allowed to Holland by the Allied Powers (Chile saltpetre, 45,000 metric tons, mineral phosphate, 40,000 tons) can be gathered from the following figures showing the excess of imports over exports during the years 1912, 1913:—

	Metric tons 1912	1913
Chile saltpetre	74,406	82,490
Ammonium sulphate ...	7,958	12,475
Guano	2,344	11,345
Basic slag...	185,485	240,259

The fertility of Dutch soil has suffered considerably from the scarcity of fertilisers during the past few years, and at the present time the quantities required are greater than those formerly consumed. It is considered doubtful if the allotted quantities, especially of phosphate, will be available in time for the next harvest, and if adequate supplies of potash fertilisers will be forthcoming. In the latter eventuality the potato crops are likely to be seriously affected.—(*N. Rotterd. C.: Z. angew. Chem., Jan.* 21, 1919.)

Recent Developments in the Electro-Chemical Industry of Italy.—The first electrolytic plant to be established in South Italy is that of the Elettrochimica Pompilio at Naples, where the production of chlorine, caustic soda, hydrogen, and chlorine derivatives was commenced in March 1918. The total area available for the works is 1,500,000 sq. ft. of which one-tenth had been covered with buildings in November 1918. Owing to war conditions, it has

been necessary for the company to construct nearly all the plant and much of the machinery, and at present 300 workmen and 50 technical employees are engaged, but when the plant is completed only about 30 technical workers will be needed to run the entire plant, which will absorb approximately 2000 kilowatts per day.

Diaphragm cells are employed, fitted with carbon anodes, and the salt needed for the concentrated brine electrolyte, after being freed from sulphate by treatment with barium chloride, is pumped to the electrolytic cells of which there are three batteries each taking 500 h.p. The installation consists of electric power and evaporating plant, electrolytic cells in which chlorine, hydrogen and caustic soda liquor are produced, and compression plant for collecting hydrogen and chlorine in cylinders. During electrolysis the brine is circulated, and the evolved chlorine is either liquefied after drying in towers containing sulphuric acid, or converted into hypochlorite or other derivatives. The caustic liquor is conveyed to large concrete or iron reservoirs situated in cellars beneath the electrolysers. Rotary pumps are extensively employed and all mechanical parts are duplicated in order to avoid any stoppage through breakdown.

An excellent market exists in South Italy for caustic soda and chlorine derivatives, and much of the chlorine will probably be utilised in paper and textile mills. It is claimed that this plant is the most modern in the country and the company is prepared to adopt anticipated improvements in the electrolytic process as well as in the working up of the caustic soda and chlorine.—(*U.S. Com. Rep., Jan.* 22, 1919.)

German Substitutes for Manganese.—The German Luxemburg Mining and Smelting Co. has discovered the possibility of replacing a large proportion of the manganese required in the basic Bessemer process by calcium carbide. Quite recently the Haspe Iron and Steel Works has reverted to an old process which was designed to save manganese, but which was given up when the cheapness and abundance of manganese rendered it unprofitable. The old process has been so much improved that it enables steel to be produced at from 2*s.* to 3*s.* a ton cheaper than is possible by the calcium carbide process. The improved process has been placed gratuitously at the service of the Association of German Ironmasters.—(*Iron and Coal Tr. Rev., Mar.* 7, 1919.)

Fluorspar and Cryolite in the U.S.A.—According to the recent report by E. F. Burchard a record quantity of fluorspar—200,000 tons—was mined in the United States in 1917 in order to meet the great demand for this mineral as a flux in the basic hearth steel furnaces and for the chemical, ceramic and other industries. This amount represented an increase of 40 per cent. in quantity and it was sold at 40*s.* 7*d.* per ton f.o.r., as compared with 24*s.* 8*d.* in 1916. For prompt delivery at the furnaces, quotations rose to 89*s.* in 1917 and to 167*s.* in 1918. Some 30,000 tons were also mined at Madoc, Ontario, in 1917, representing about four times the output in 1916 and three times the amount required by the Canadian steel works. The chief demand was for gravel soar for the furnaces, which absorbed 83 per cent. of the whole output, the remainder consisting of 12 per cent. of lump and 5 per cent. of ground fluorspar. Three quarters of the American fluorspar was mined in Illinois, one fifth in Kentucky, and the remainder in Colorado, Arizona and Hampshire; but Nevada, Utah and Washington contain large supplies which were formerly worked. The works have a capacity of more than double their 1917 output, the difference being due chiefly to shortage of labour, wagons and boats, and to unfavourable weather. The imports of fluorspar have gradually diminished and in 1917 only amounted to 12,000 tons; this material is of lower grade than the Illinois, Kentucky product and is chiefly used where the American product is not available. For optical purposes, fluorite should be as clean and colourless as glass. Really good pieces fetch 22*s.*—45*s.* per lb.

No native cryolite is mined in the U.S.A. The whole requirements of the country—21,000 tons—are supplied by Greenland. The average price in 1917 was £10 per ton, which is just double that of the years 1911-15. Cryolite is admitted free of duty. —(*U.S. Geol. Surv., Nov.*, 1918.)

PARLIAMENTARY NEWS.

HOUSE OF COMMONS.

National Factories.

In Committee of Supply, Mr. Kellaway said that the estimated value of the goods which the Government had to dispose of varied from £200,000,000 to £1,000,000,000, and that probably the former figure would be realised. There are 130 national factories which the Government is now free to sell, and upon them some £60,000,000 had been spent. The total cost of all factories was £65,000,000 including £28,000,000 expended on explosives and chemical works. Seven of the 130 factories would be maintained to supply munitions to the post-bellum army, 13 would be leased or sold, and of the remainder the majority will be sold but 30 will be retained for storage purposes. So far only one factory had been disposed of; it cost £133,000 to build and the selling price was £140,000. He did not share the view of the Labour Party that the factories should be run by the Government and used to compete with private trade. The policy of the Government was not to try tinkering little experiments for producing a few things which could be produced better by men producing them in greater quantity, but to get the wheels of industry running smoothly and to restore confidence to all interests connected with industry.

In the course of the same debate, Sir W. Pearce said it would not be difficult to prove that large factories like Gretna have paid for themselves by the large quantities of explosives which they have produced. Gretna covers 9000 acres, of which 6000 are good arable land, and there is housing for 14,000 or 15,000 people. It would be extremely difficult to adapt the big plant there to produce only about 10 per cent. of its capacity, and he suggested that the buildings and land should form the nucleus of a very large settlement for discharged soldiers and sailors. Large sections of the chemical industry have been left in an extremely difficult position, and he knew a whole class of chemical manufacturers whose pre-war activities had been completely destroyed by the necessity of having to make chemicals for munitions of war.—(Mar. 5.)

Government Trade Policy.

In Committee of Supply, Sir Auckland Geddes, Minister of National Service and Reconstruction, said that the general policy of the Government was to reduce the prices of the raw materials it possessed or controlled to a level not higher than the anticipated pre-war prices; at the same time it is proposed to retain sufficient reserves of raw materials to enable the Government to defeat any attempt at a hold-up by merchants. If prices were brought down too low, production would be checked, and the ultimate consequences would be serious. This policy is being vigorously applied at the present time in the case of some of the non-ferrous metals. As regards imports, the transitional policy

was not to impose or continue any restrictions on goods produced or manufactured within the Empire, and raw materials required for our industries would now be admitted without restriction. Semi-manufactured articles necessary for our manufactures would also be admitted free from all restrictions, except in so far as they were produced by industries which require fostering or shielding. Manufactured articles will be subject to restrictions when not essential for consumption in this country, or when produced by industries which require to be shielded from foreign competition while they are being re-established, or which had been created or encouraged to extend owing to circumstances arising out of the war. The restrictions in such cases will continue until September 1 next, when the whole situation will be reviewed.

The new export policy involves the attempt to induce other countries to take our exports on the understanding that payment for them shall be a first charge upon the war indemnity they will receive. British traders will be kept informed of any variation of the restrictions which are imposed by other countries. There will be no restrictions upon exports except in the case of (1) goods required for naval and military purposes, (2) goods required for home consumption or manufacture, and (3) goods which have been benefited, directly or indirectly, by subsidy or by purchase by the State. Such goods will be liable to licence on export. The same three exceptions will apply to goods destined for blockaded countries. The maximum number of manufactured goods will be transferred to the free list, and of the rest the greatest possible number will be placed on List C. (exports under licence to any destination). All facilities possible, and consistent with inter-Allied agreements, will be given to the re-export trade.

Mr. Bridgeman said the President of the Board of Trade had decided that the existing Advisory Council, under the chairmanship of Lord Emmott, should be formed into a Commission and be reinforced by the addition of representatives of manufacturers, workmen, merchants, retailers and consumers, and the joint industrial councils would also receive representation. The duties of the Commission will be, *inter alia*, to go through the list of imports, including those now restricted, and to recommend what proportion of the normal amounts should be admitted. In this way it was hoped to produce in a very short time a list of all the restrictions that were to remain: upon receipt of the report of the Commission, the Board of Trade will come to definite decisions; in the meantime it will be necessary to issue a number of licences.—(Mar. 10.)

Export of Spraying Mixtures to France.

Mr. Bridgeman, answering Col. Wedgwood, admitted that heavy losses were threatened to manufacturers of, and dealers in, copper sulphate and spraying mixtures, owing to the repudiation of contracts by French importers, consequent on the lowering of prices by the French Government. —(Mar. 10.)

Empire Sugar.

In response to a question put by Mr. Grattan Doyle, Col. Amery, Under-Secretary of State for the Colonies, said that proposals for the development of the sugar industry in the British Dominions overseas have been received, and are under the consideration of the Secretary of State for the Colonies, and that experiment and research for the improvement of the sugar industry is being carried out with the assistance of H.M. Government, and of certain of the oversea Governments as well as by private enterprise.—(Mar. 10.)

Poisons and Pharmacy Act, 1908.

Sir J. Agg-Gardner asked the Home Secretary if any action has been taken under Section 4 (b) of the above Act to enable certified assistants to apothecaries to be registered as pharmaceutical chemists or chemists and druggists. In reply, Mr. Shortt stated that the Pharmaceutical Society is now considering the matter, and it is hoped that before long a by-law in the sense indicated will be submitted for the approval of the Privy Council. —(Mar. 10.)

Ministry of Ways and Communications.

The second reading of this Bill was moved by Sir E. Geddes, who said that the railways were earning 4·3 per cent. (on the capital expended) before the war, but were now run at a loss of 3—4 per cent. (£100,000,000 per annum); canals, excluding the Manchester Ship Canal, before the war earned 2 per cent., to-day they were working at a loss, although heavily subsidised. Roads cost the country 20 millions a year. Docks not railway owned were earning about 3 per cent. The object of the Government was to put back these means of transport on to a self-supporting basis. Private interest had made for progress in the past, but to-day it spelt waste. There was an enormous wastage in empty haulage, and one of the first things to be done was to acquire on fair terms the 70,000 privately owned wagons. Wagons should be enlarged, terminals improved, standardisation introduced throughout, and great economy would be effected by using heavy electric locomotives for goods haulage. Light railways, which covered 836 miles, should be developed; and docks and harbours must be taken over to make the control of transport complete and the projected economies effective. Unification of control will lead to the opening up of districts, and the development of industries. When the railway main lines are electrified—which should be done promptly—fully 20 per cent. of the electricity of the country can be used for traction. Such a change would be remunerative; not only would the price of current be reduced but it would allow of greater density of traffic over the line. It is a fallacy to suppose that it would be against the interests of the railways to develop the industrial use of electricity. Under the Bill, it is proposed that the Government should acquire temporary powers for two years, after which it would have to come back to Parliament for permanent powers. During the two years an endeavour must be made to lift the dead hand which is on development, and the mode of procedure would not be by Orders in Council, as originally intended.

Opposition to the measure was mainly centred on the provisions regarding the docks, harbours and roads, and exception was taken to the autocratic power which would be given to the Minister concerned. In closing the debate, Mr. Bonar Law said that the Bill involved a complete change in the economic policy of the country, but that existing conditions warranted its acceptance. The second reading was passed without a division.—(Mar. 17, 18.)

Recommendations of Coal Commission.

Mr. Bonar Law announced the terms of the Interim Report of the Coal Commission (this J., 1918, 89 R). The Report consists of three separate documents, *viz.*, (1) that of the chairman (Mr. Justice Sankey) and the three independent members nominated by the Government, (2) the report of the coalowners' representatives, and (3) the findings of the representatives of the miners. The first report recommends an immediate increase in wages of 2s. per day; a seven-hour day as from July 16 next, and a six-hour day from July 1921, if the

economic condition of the industry can stand such a change; judgment is suspended on the question of nationalisation, but the present system of ownership and management is condemned, and for it should be substituted either nationalisation, or a method of unification by national purchase or by joint control. In any case, the colliery workers should have an effective voice in the management. Further, 1*d.* per ton on the present output (£1,000,000 a year) should be allocated to the improvement of housing and amenities in each colliery district. These recommendations have been accepted by the Government.

The mineowners' representatives recommend an advance in wages of 1*s.* 6*d.* per day, a seven-hour day, and do not pronounce on nationalisation. The workers' representatives recommend the adoption of the full demands of the miners (this J., 1919, 89 R). —(Mar. 20).

GOVERNMENT ORDERS AND NOTICES.

PROHIBITED EXPORTS.

Existing export prohibitions have been relaxed in the following cases:—

Headings transferred from one list to another.

From List A to List B.

Barium sulphate; potassium chlorate and mixtures containing; potassium cyanide and mixtures containing; potassium perchlorate; potassium prussiates and mixtures containing.—(Mar. 20.)

From List A to List C.

Binder twine; chestnut extract, liquid; flax shakings; flax tow; gluestock of all kinds, including animal hoofs, untanned hides and pelts, not otherwise specifically prohibited; hides and pelts, clippings of; invert sugar; lead-coated sheets; pigskins; pipes, cast-iron, and cast-iron pipe fittings and connexions; quebracho extract and extracts containing quebracho; terneplates; tinplates.—(Mar. 6.)

Cork and cork dust; cryolite; gold beaters' skin; lead, dry, white; paper, waste; resins; wax, paraffin.—(Mar. 13.)

Santonin and its preparations; sulphonal; casein and preparations thereof; jute threads; pulp-board waste; straw-board waste.—(Mar. 20.)

From List B to List C.

Chrome ore; ferro-vanadium.—(Mar. 13.)

Soda, bichromate of; gall nuts.—(Mar. 20.)

Altered Headings.

(A) Whisky. (C) Spirits, potable, not otherwise prohibited. (A) Sugar, cane and beet. (C) Articles, mixtures, and preparations containing sugar not otherwise prohibited.—(Mar. 6.)

(A) Cotton, Egyptian. (B) Cotton, raw, other than Egyptian. (A) Glucose, liquid. (C) Glucose, solid. (A) Rice, and rice-flour. (C) Articles, mixtures and preparations containing rice or rice-flour not otherwise prohibited. (A) Silk, raw, thrown and waste. (A) Artificial silk yarn. (C) Silk and silk manufactures not otherwise prohibited including artificial silk manufactures.—(Mar. 13.)

(A) Asphalt. (C) Articles containing asphalt not otherwise prohibited. (A) Bitumen. (C) Articles containing bitumen not otherwise prohibited. (A) Oils and fats, edible, including blends of two or more edible oils and fats, except the following, which are on List C:—Hemp seed oil, kapok seed oil, maize oil, mowrah seed oil, niger seed oil, olive oil, poppy seed oil, rape seed oil, shea butter, sunflower oil.—(Mar. 20.)

Consolidated List of Free Exports.—The Board of Trade has issued (March 15) a consolidated list of goods which may be exported without licence or guarantee and which has been adopted by all the Associated Governments. Certain articles (including barium sulphate, β-naphthol, henbane, opium and dyes) are retained upon the Prohibited List, but guarantees against re-export will not be required in respect of them. The List is given in the *Board of Trade Journal* of March 20.

Trade with North Russia.—It is officially announced that licences will be granted for the export to Archangel and Murmansk of the following goods: Cement (100 tons), candles (25 tons), starch, varnish, glassware, paints, common soap, caustic soda and silicates, kerosene, photographic chemicals, gum, etc.

PROHIBITED IMPORTS.

Import of Raw Materials.—The Board of Trade has notified (Mar. 11) that general licences have now been issued to the Customs which, together with the general licences already in existence, will exempt all raw materials from the operation of the Prohibitions of Import. The following are the raw materials which have from time to time been under prohibition and are now free:—Antimony ore; diatomite or infusorial earth; gum copal; gum kauri; hides, wet and dry; horns and hoofs; ivory (vegetable); jute; soya beans; stones and slates (including sawn and hewn but not dressed); sugar cane; tallow, unrefined; wood and timber, hewn and sawn, planed and dressed of all kinds, hardwoods and sleepers (but not including staves, pitprops and pitwood).

Any inquiry arising out of a doubt whether an article is to be regarded as a raw material or a semi-manufactured article should be addressed to the Department of Import Restrictions, 22 Carlisle Place, London, S.W. 1.

The President of the Board of Trade has appointed a Council to consider the existing list of prohibited imports (see p. 110 R, col. 1, of this issue). The *personnel* of the Council is not yet complete, but the following have consented to serve:—Lieut.-Col. Sir S. Hoare (chairman). Appointed by the Board of Trade: Sir F. Warner, and Messrs. A. F. Bird, J. D. Kiley, E. Manville, A. M. Samuel, J. Gavin, W. L. Hichens, J. A. Milne, G. A. Moore, P. Ashley and R. E. Enthoven. The Association of Chambers of Commerce have nominated: Messrs. A. B. Bell, J. W. Murray, E. B. Tredwen, F. Moore and J. Peate; and the Federation of British Industries: Messrs. G. E. Alexander, T. Bolton, F. R. Davenport, R. G. Perry (Association of British Chemical Manufacturers) and Mr. H. Summers.

In addition to these the following bodies have nominated representatives:—The National Union of Manufacturers (2), the Ministry of Labour (to represent Whitley Councils (4), the Association of Trade Protection Societies (1), the National Chamber of Trade (1), the Parliamentary Committee of the Co-operative Congress (1), the Parliamentary Committee of the Trades Union Congress (2), and the Treasury (1).

The Council has decided to appoint five subcommittees:—(1) Textiles and apparel, (2) Glass and leather, (3) Motor-cars and manufactures of wood, (4) Machinery and hardware, and (5) Fancy goods and miscellaneous manufactures. The Secretary to the Council is Mr. H. J. Phillips, Department of Import Restrictions, 22, Carlyle Place, S.W. 1.

NEW ORDERS.

The Edible Oils and Fat (Maximum Prices) Order, 1919, Ministry of Food.—(Mar. 3.)

The following Orders, etc., have been made by the Minister of Munitions:—

The Ammonia and Ammoniacal Products (Suspension) Order, 1919.—(Mar. 11.)

The Waste Paper (Dealings) (Revocation) Order, 1919.—(Mar. 14.)

The Bismuth Control (Suspension) Order, 1919.—(Mar. 14.)

The Potassium Compounds (Partial Suspension) Order, 1919.—(Mar. 14.) [This Order suspends the Potassium Compounds Order, 1917, in so far as it relates to kelp.]

The Building Bricks Control (Complete Suspension) Order, 1919.—(Mar. 18.)

The Turpentine, etc., Control (Partial Suspension) Order, 1919.—(Mar. 18.) [This Order relates to the Turpentine, etc., Control Order, 1918, but does not apply to Turpentine Substitute, as defined in that Order (this J., 1918, 59 R).]

The Seeds, Oils and Fats General Licence, 1919.—(Mar. 18.)

The following Orders have been cancelled by Notice:—

The Imported Wool (Shipment) Order, 1917, as from April 1, 1919. Army Council, March 6.

The New Zealand Hemp (Maximum Prices) No. 2 Order. Army Council, March 6.

The Raw Cotton (Prices and Returns) Order, 1918. Board of Trade, March 14. [This revocation applies to all growths of cotton, except American and Egyptian.]

The Japanese Silk Order, 1917. Admiralty, March 17.

The Paper Making Materials (Home Produced) Order, No. 2, 1918.

The Sugar (Brewers' Restriction) Orders, 1917 and 1918. Ministry of Food.

OFFICIAL TRADE INTELLIGENCE.

(From the Board of Trade Journal for March 6, 13 and 20.)

TARIFF. CUSTOMS. EXCISE.

Australia.—The importation of kerosene in tins branded or labelled on the sides or bottom is now permitted.

The import of dyes of other than British origin is prohibited, save with the consent of the Minister for Trade and Customs.

Argentina.—It is proposed to revise the official valuation tariff.

Bermuda.—After January 6, import licences will only be required for certain foods and feeding stuffs.

British Guiana.—The import duties on paints, salt and spirits have recently been modified, and an export tax of 1 per cent. per lb. has been levied on balata.

China.—A copy of the proposed new Draft Tariff may be seen by persons interested at the Department of Overseas Trade.

French West Africa.—The export of ground nuts is prohibited as from March 4.

Federated Malay States.—The ordinary duty and the additional duty on exported cultivated rubber have been amended as from January 3.

Johore.—The export duty on cultivated rubber has been re-imposed as from January 1.

Kedah-Perlis.—The export duty on cultivated rubber has been re-imposed as from January 1.

Morocco (French Zone).—The export of hides and skins is now permitted.

Netherlands.—It is proposed to increase the export duties on mineral oil and by-products thereof from the Dutch East Indies.

South Africa.—The Customs and Excise duties at present in operation are to remain in force for the year 1919-20.

Spain.—The export duty on argentiferous lead is suspended until May 31.

Switzerland.—After February 16 the export of kapok, albumin, asphalt, and certain minerals and chemicals is permitted under general licence.

United States.—Recent rulings of the War Trade Board affect oil cakes, lard compound, lard substitutes, quinine and cinchona bark.

The special export licence "R.A.C. 42" for in-transit shipments has been revised and new provisions made, and certain other export licences have been modified.

Individual licences are still required for the import of emery, ferromanganese, spiegeleisen, nitrates, tin, tin ores, tin concentrates and many organic compounds of arsenic.

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 73, Basinghall Street, London, E.C. 2, from firms, agents or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

Locality of Firm or Agent.	Materials.	Reference Numbers.
Australia ..	Chemicals, dyes, inks, gums, resins, waxes and lubricants ..	422
..	Drugs and edible oils ..	316/9/12*
Canada	Drugs	339
,, ...	Chemicals, medicines, soap	384
,, ...	Druggists' sundries ..	385
,, ...	Rubber, rubber tubing and filter paper ..	340, 434
India	Metals	428
,, ...	Machinery for making artificial manures ..	432
,, ..	Dyes, paints, oils, matches and paper	280
South Africa, South America and Australasia	Chemicals, tar oils and greases	388
Belgium ..	Metals and ores	351
,, ...	Paints and varnish ..	353, 354
,, ...	Chemicals and oils ..	448, 449
France	Chemicals	359, 454
,, ...	Glassware of all kinds ..	363
,, and Colonies	Paper	366
Italy (Milan) ..	Chemicals for agricultural purposes	370
,, ..	Celluloid and galalith ..	458
,, (Rome) ..	Lubricating oils	409
,, (Messina)	Margarine	408
,, (Rome)	Chemicals, oils and soap	1597, 1618†
,, (Genoa)	Paper, inks, paints, and varnishes	1596†
,, (Florence)	Chemicals, drugs, paints and soap	1598, 1615†
,, (Genoa)	Chemicals, metals, fire-clay and bricks ..	1603†
,, (Bologna)	Chemicals and fertilisers	1609†
,, (Bologna, Genoa)	Dyes, paints, colours, oils and varnish	1625, 1631†
Greece	Pharmaceutical goods ..	407
,, (Corfu) ..	Paper	369
Holland	Rubber and asbestos ..	374
Spain (Bilbao) ..	Chemicals, dyes, drugs, varnishes and paints	376
,, (Madrid) ..	Rubber, inks, drugs and celluloid	415
Switzerland ..	Drugs	470
Porto Rico ..	Paints	377
Venezuela ..	Soap, earthenware ..	473
Panama ..	Paper	413
Buenos Aires ..	Chemicals	—
,, ..	Iron, steel, tin plate, paper and cardboard	441

* Official Secretary, Commonwealth of Australia, Commercial Information Bureau, Australia House, Strand, W.C. 2.

† The Secretary, British Chamber of Commerce for Italy, 7 Via Carlo Felice, Genoa.

British manufacturers of plated soft copper wire in gauges ·004, ·006, ·011, ·015, ·018, ·0085, litmus paper, monochlor- and dichloracetone are invited to apply to the Department of Overseas Trade for the names of inquirers.

TRADE NOTES.

BRITISH.

Canadian Foreign Chemical Trade in 1918.—The summary of trade for 1918 is now available. Canada imported during the year drugs, dyes and chemicals to the value of $33,651,382, which was an increase of about $7,000,000 over previous years. Imported oils were valued at $41,724,175, showing an increase of $12,000,000 over 1917.

Exports		1917	1918
Hides and skins	$	8,973,935	5,109,350
Leather	$	10,647,428	13,370,371
Aluminium, ingots, &c.	cwt.	223,246	216,165
,,	$	7,620,953	7,223,570
Asbestos	tons	146,020	141,598
,,	$	5,334,282	8,014,769
Copper	$	23,256,278	20,772,109
Gold	$	15,929,051	10,040,813
Iron and steel	$	43,929,069	50,794,850
Nickel	cwt.	812,724	874,785
,,	$	8,708,650	11,263,246
Silver	oz.	21,718,784	19,357,076
,,	$	17,621,398	18,382,902
Other metals	$	11,752,630	11,616,974
Paper, printing	cwt.	11,923,737	12,730,671
,, ,,	$	32,561,020	37,301,269
Other paper	$	3,372,931	6,379,713
Textiles	$	16,884,601	17,350,979
Wheat flour	barrels	8,770,698	10,070,881
,, ,,	$	79,141,990	108,301,840
Wood pulp	cwt.	10,236,072	11,678,225
,, ,,	$	26,192,906	33,359,923

FOREIGN.

The Swiss Chemical Industry.—In an article on the development of the Swiss chemical industry, the *Schweizer'sche Industrie-Zeitung* states that the disappearance of Germany from the world's markets has given such an impetus to the Swiss chemical industry that it has become one of the most important factors in the economic life of the nation. The manufacture of coal tar dyes, the most important branch, is likely to become more active with the advent of peace. During the past 10 years the Swiss chemical industry has practically written off the cost of all its plant, and it has accumulated reserves which bear a high proportion to the issued capital. These two factors, together with the recently effected combine of Swiss dye manufacturers (this J., 1918, 385 R), will add enormously to the competitive power of the Swiss industry. The very costly scientific experimental work will in future be so organised that duplication is avoided, and fruitless commercial efforts will also be obviated; further, the manufacture of any given dye will be centralised in one establishment, and profits will be pooled according to an agreed plan.

In the years before the war, over 80 per cent. of the sulphuric acid imported into Switzerland came from Germany, France supplying most of the remainder. As a result of the war, France has become the chief source of supply, but a large measure of independence has been achieved by the progress made in the home manufacture from gypsum: in 1917 the weight of acid imported was only about one-fifth of what it was in the pre-war years, and during 1918 about one-third. Germany had also a practical monopoly of the trade in acetic acid; this has been lost entirely, and the United States supplies some 70 per cent. of the total import. Here again the home manufacture (carbide process) has made great headway, and the imports have decreased by about 40 per cent. As regards coal tar derivatives and dye intermediates, the virtual monopoly possessed by Germany has been completely lost in favour of England and France, who have sent these materials to be worked up into finished products. The German monopoly in respect of aniline has been transferred to England and the United States. The manufacture of aniline compounds in Switzerland has made rapid strides during the war; those now imported come from England, the United States and France. The change has benefited Switzerland, for the dyes produced from these compounds are exported to the countries named, whereas formerly but very little went back to Germany.

In regard to exports of finished dyes, the pre-war trade was about equally distributed between Germany, England and the United States; at the present time Great Britain and her colonies are the largest customers. Although the total exports are less than before the war, the value is about four times greater. Switzerland has taken full advantage of the war to secure for herself those markets in which Germany previously held a monopoly. The exportation of indigo began in 1911, and this trade is still in its infancy.

The following statistics illustrate and amplify the foregoing information. As the returns for 1918 are not complete, the figures for that year have been calculated from those that were available.

IMPORTS

Material	Year	Metric tons	Price per ton in £'s	Source %
Sulphuric Acid ..	1913	9611	3·1	Germany, 92·4 France, 7·4
,, ..	1915	213	4·25	France, 13·0
,, ..	1917	1908	14·2	France, 64·6 Spain, 19·5
,, ..	1918	3286	7·9	France, 46·6 Austria, 32·4
Acetic Acid ..	1913	2018	11·9	Germany, 38 Holland, 23
,, ..	1915	1660	126	Germany, 40 U.S.A., 38
,, ..	1917	1941	112	U.S.A., 63 Austria, 16
,, ..	1918	1243	107	U.S.A., 73 Austria, 20
Coal Tar Derivatives	1913	3326	28·5	Germany, 86 U.K., 10
,,	1915	1177	69·5	U.K., 57 Germany, 20
,,	1917	4967	72·5	Austria, 30 Germany, 27
,,	1918	3497	129	U.K., 55 France, 16
Aniline	1913	1202	49	Germany, 98 U.K., 2
,, ...	1915	945	120	U.K., 89 Germany, 8
,, ...	1917	1031	208·5	U.K., 57 U.S.A., 40
,, ...	1918	1773	208	U.K., 72 U.S.A., 18
Aniline Compounds for Dye Manufacture	1913	887	125	Germany, 96 U.K., 4
,,	1915	92	268·5	U.K., 63 Germany, 35
,,	1917	250	477	U.S.A., 45 U.K., 44
,,	1918	413	496·5	U.K., 96 France, 4
Coal Tar Dyes ..	1913	698	165	Germany, 96 U.K., 2
,, ..	1915	234	300	Germany, 100
..	1917	429	748	Germany, 100
,, ..	1918	337	804·5	Germany, 100

Exports.

Material	Year	Metric tons	Price per ton in £'s	Destination %
Coal Tar Dyes ..	1913	7035	176·5	Germany, 20 U.K., 20 U.S.A., 18
,, ..	1915	4801	301·5	Brit.Emp., 52 Italy, 16 U.S.A., 15
,,	1917	5127	845	Brit.Emp., 50 France, 15 U.S.A., 14
.. ..	1918	4812	859	Brit. Emp.,48 France, 17 Italy, 14
Indigo	1913	1792	109	China, 72 U.S.A., 12
,, ...	1915	950	118·5	U.S.A., 38 France, 31
,, ...	1917	1472	371·5	U.S.A., 48 U.K., 36
,, ...	1918	777	391	U.S.A., 41 France, 23

—(*Z. angew. Chem., Jan.* 17, 1919.)

Medicines Employed in Chinese Therapeutics.—China exports annually more than £600,000 worth of medicines, and the internal trade is enormous. The materia medica is very rich, a consular report giving a list of 189 medicines of vegetable and 31 of animal origin which were made and used in Szechwan alone. Liquorice and rhubarb are of most interest to foreigners, but ginseng, pomegranate root, aconite, opium, arsenic and mercury are also of importance. Manufacturers of drugs will find in China some valuable sources of supply for raw material. Foreign exploiters of patent medicines have found China a rich field for their products.—(*U.S. Com. Rep., Feb.* 8, 1919.)

Lead and Zinc in China.—The principal lead mine in China is in Hunan, which in the last twenty years has produced 50,000 tons of lead and 126,000 tons of zinc concentrates. White lead is manufactured practically only for domestic use, the exports in 1917 amounting to 100 tons. The metal is rolled into sheets and treated at a slow heat with rice vinegar. The product is dried, pressed into cakes, or mixed with wood oil for use in common paint. The war has affected the zinc trade of China adversely, owing to the high freight rates and the unfavourable silver exchange. The export of spelter dropped from 38,000 piculs in 1915 to 7000 piculs in 1917, and the export of zinc ore from 140,000 piculs in 1915 to 4000 piculs in 1917 (1 picul = 133⅓ lb.). Hunan is the main source of supply; the output in 1914 was 12,000 tons.—(*U.S. Com. Rep., Nov.* 27, 1918.)

The Paint Trade of Brazil.—Before the war, the paint trade of Brazil was largely in British hands, although Germany was beginning seriously to challenge that supremacy. The following figures show the imports of unprepared dry paint in the last normal year, 1913, together with the countries of origin: Germany, 964,615 kilo., England 742,625 kilo., U.S.A. 7194 kilo., France 487,695 kilo. In the same way, the imports of prepared paints were: Germany 249,380 kilo., England 1,681,222 kilo., U.S.A. 334,819 kilo., and France 113,677 kilo. During the war, American suppliers have benefited largely at the expense of the British manufacturer, but it is felt that the quality and cheapness of the British product will regain most of this trade. A British company is utilising certain local clays which, ground into powder and worked up with linseed oil and turpentine, yield very good white, red, grey and yellow paints. Intending exporters from the United Kingdom should note that varnishes pay twice as much duty as ordinary paint, so that great care should be taken to specify correctly the class of paint invoiced.—(*Bd. of Trade J., Mar.* 6, 1919.)

Prices of Sugar in Principal Countries.—Dr. H. C. Prinsen Geerligs has compiled a list of wholesale prices of sugar in the principal producing and consuming countries on October 1, 1918. The list is given below, with prices expressed in pence per lb. These prices include excise taxes and other imposts, except in the case of Poland: Java, 1·14*d.* per lb.; Denmark, 3·34*d.* per lb.; Cuba, 3·62*d.*; U.S.A., 3·75*d.*; Germany, 3·88*d.*; Sweden, 4·50*d.*; Netherlands, 1·69*d.*; Switzerland, 4·90*d.*; United Kingdom, 6·27*d.*; Poland, 6·47*d.*; Norway, 6·68*d.*; Spain, 6·78*d.*; Austria, 6·86*d.*; France, 7·57*d.*; Hungary, 9·76*d.*; Italy, 9·85*d.*; Belgium, 12·52*d.*; Ukraine, 51·34*d.*; and Turkey, 227·10*d.*—(*U.S. Com. Rep., Feb.* 8, 1919.)

Uruguay in 1917.—Uruguay is primarily a pastoral country; mining is of little importance. It has numerous quarries which produce a wide variety of fine and common stone, and peat extraction is in the experimental stage. Among its few industries may be mentioned cement manufacture, but there is only one factory. As a result of the shortage of chemicals, the manufacture of a certain number of the commoner products has been carried out by the National Institute of Industrial Chemistry at Monte Video.

While Germany held first place in the Uruguayan export trade in 1913, in 1917 the first four countries were the United States, the United Kingdom, France and Italy. Imports were valued at £14,000,000, including drugs and chemicals, £140,000, and pharmaceutical specialities, £65,000.—(*U.S. Com. Rep., Dec.* 10, 1918.)

COMPANY NEWS.

COURTAULDS, LTD.

In the report for the year ended December 31, 1919, the directors state that they have given very full consideration to various plans for carrying out the proposed capitalisation of surplus assets (amounting to about £8,000,000, *v.* this J., 1918, 103 R), and also for the reorganisation of the Company. The scheme originally proposed failed to meet with the approval of the Treasury, and the opinion of the legal authorities consulted is that the proposals cannot be carried out until the points of law involved are satisfactorily settled.

During the past year an additional factory at Leigh, Lancashire, for the manufacture of textile materials, has been purchased, and the output therefrom has been very satisfactory. A research laboratory has been installed at Clapham. The cost of the shares acquired in the Russian Viscose Company has now been entirely written off. The profits of the year, after deducting all expenses, including excess profits duty and income tax, amount to £1,184,938 (issued capital, £2,000,000, debentures £14,170). After writing off sums amounting to £66,751 and placing £382,908 to special reserves, the payment of a final dividend of 3*s.* 6*d.* per share, free of tax, is recommended. A dividend of 3*s.* per share, less tax, was paid in August last. The reserve funds now stand at £1,940,465, no valuation is put upon the holding of $9,488,600 in the American subsidiary, Viscose, Ltd., and the carry forward is £148,210.

MAGADI SODA CO., LTD.

At an extraordinary general meeting held on March 17, the Chairman, Mr. S. Samuel, said that the Company had spent all its capital in consequence of the war, and that it had been decided to submit to the shareholders the proposal to create £500,000 ordinary shares of £1 each, and to issue £500,000 of debentures with the right to holders to convert into ordinary shares up to June 30, 1924. The new capital was required to pay off existing loans, to provide the necessary machinery so as to dispense with manual labour as far as possible, and to provide working capital. There was a great future before the Company, which possessed unlimited supplies of a material which was consumed in enormous quantities. The resolution to increase the capital was carried unanimously.

British Chemical Trade Association. This Association has been registered as a company limited by guarantee, not formed for purpose of profit. Its objects are, *inter alia*, to promote trade in chemicals, to provide for the accurate sampling, analysis, and examination of chemicals, to establish uniformity in commercial usages (forms of contract, charter parties, bills of lading, insurance policies, etc.), and to promote the voluntary adoption thereof, to act as arbitrators, etc. The president of the general committee is Mr. W. Mann, 7, St. Michael's Alley, E.C., and the registered office is at 80, Fenchurch Street, E.C. 2.

REVIEWS.

The Zinc Industry. *By* Ernest A. Smith. *Monographs on Industrial Chemistry, edited by* Sir Ed. Thorpe. *Pp. viii + 223, with 4 plates and 9 figures. (London: Longmans, Green and Co. 1918.) Price 10s. 6d. net.*

Judging from the literature on the subject, the zinc industry has received scant attention at the hands of British metallurgists, for, while America, France and Germany has each produced within recent years at least one authoritative work, none has been published in this country since Percy's "Metallurgy of Copper, Zinc and Brass" appeared in 1861.

The author gives a general survey of the history of the industry from the days when brass was obtained by melting copper with zinc carbonate ore, by the process known as "cementation," through the various stages of progress up to modern retort practice in Europe and America. In an interesting introduction we read again (and it is well that it should be thus recorded in more permanent form) the melancholy tale of the position in which England found herself at the outbreak of war; that is to say, dependent on foreign countries for at least three-fourths of her requirements of zinc, although the Empire was possessed of adequate resources of raw material, which was, however, for the most part under contract to Belgium or enemy countries.

Statistics are fully quoted in the chapter describing the rise and progress of the production of zinc in the producing countries of the world. The United States takes first place with a production in 1913 of 320,000 tons, equivalent to 32 per cent. of the world's supply. Since then, the U.S. production has reached nearly twice the pre-war figure. The apparent neglect, hitherto, of the industry in Great Britain is attributed by the author to various causes, chief among them being that the British smelters, generally, have neither looked sufficiently ahead to the time when supplies of the easily smelted ores would have diminished, nor availed themselves to any extent of the enormous progress made by Continental smelters in furnace construction whereby fuel economies were effected and former considerable losses were reduced.

It is not to be expected, perhaps, that metallurgical operations should be described in very full detail in a monograph of the kind; nevertheless, the author has contrived successfully to give a concise and interesting outline of the main principles relating to the preliminary treatment of mine ore (concentration), the roasting and smelting, and to include descriptions of furnaces and appliances employed. It is pleasing to read that there has been a considerable advance in the methods of British zinc works during the past four years, and that wherever new plant has been installed it has been of the modern type and should be productive of results equal to those obtained on the Continent. The author discusses the difficulties in connexion with the sweet roasting of ferruginous and leady zinc blende at some length and is, perhaps, somewhat sanguine respecting the results obtained by the employment of mechanical muffle furnaces. Notwithstanding the notable progress made in their construction, generally speaking these do not seem to have yet been completely successful, in this country, in overcoming the several difficulties. The importance of by-product sulphuric acid is emphasised by the author, who points out that, in the recovery of the sulphur from blende roasting, the British smelters have been hitherto far behind the smelters on the Continent and in America. Summing up published results, the author states that electric smelting of zinc ores has now passed beyond the experimental stage and become a success. The text does not appear quite to bear this out, particularly in regard to the large amount of fume formed in the condensation of the zinc vapour, considerably exceeding that obtained in ordinary retort practice. Recently published researches in America by Prof. C. H. Fulton indicate that this is due to the difficulty of keeping the electric smelting furnace air-tight and of rapidly obtaining, and maintaining, a uniform temperature throughout the distillation chamber. Progress relating to wet methods of extraction and electro deposition is touched upon and it may be mentioned that, since the book went to press, some of the plants that are mentioned as being in course of construction are now being successfully operated. Other sections deal with the marketing of zinc, industrial applications of the metal, alloys and commercial compounds of zinc and the future of the industry. An admirably selected bibliography concludes a monograph that forms a notable addition to the literature of zinc; clear and concise in language and collecting in convenient form much valuable scattered information.

One of the most interesting sections is that devoted to the future of the zinc industry in Great Britain and the author is genuinely, and rightly, concerned at the inadequate measures taken to ensure a production to equal the demand. Since the book was published it appears that, after allowing for the proposed extension of existing works and the erection of new works at Avonmouth, the possible output will be less than one-half the pre-war consumption of, say, 200,000 tons yearly. It has recently been announced that a zinc smelter is to be erected at Sakchi, India, by the Burma Corporation conjointly with Messrs. Tata and Sons. This, together with other proposals for the expansion of smelting and electrolytic works in Australia, Tasmania and Canada, will help to make up the deficiency. The future position of the zinc industry is, moreover, one of great complexity. On the

one hand we have confident estimates that the requirements of this country will amount shortly to 300,000 tons per annum, all of which we are told must be produced within the Empire. On the other hand, our estimated requirements assume a revival of our galvanised sheet trade (largely export) which depends upon a supply of steel at competitive rates. We are also faced by the fact that the retort capacity and mining equipment of the United States are far in excess of requirements, as a result of that country meeting our own deficiency during the war. The reinstatement of the Belgian works will take some time, and it must be remembered that Belgium herself consumed only 76,000 tons out of a yearly production of nearly 200,000 tons. France is contemplating an increased production, and Japan is already producing upwards of 50,000 tons yearly, which may be increased so soon as her ore supplies are assured. Production in the States has already been curtailed since the armistice, and it is realised that there must be a great expansion in consumption of the metal or else a wholesale scrapping of plant. The recently formed American Zinc Institute, which covers the mining, smelting and trade interests, is actively engaged in efforts to extend the industry in the United States.

William G. Wagner.

Catalysis in Industrial Chemistry. *By* G. G. Henderson. *Monographs on* Industrial Chemistry, *edited by* Sir Ed. Thorpe. *Pp.* 202. (*London: Longmans, Green and Co.* 1919.) *Price 9s. net.*

Catalytic Hydrogenation and Reduction. *By* E. B. Maxted. *Pp.* 104. (*London: J. and A. Churchill.* 1919.) *Price 4s. 6d. net.*

Catalytic action, once a scientific curiosity, has now passed into the realm of every-day industrial life so that whilst the applications are already numerous the potentialities are enormous. Every chemical student in the future must have more than an elementary knowledge of catalysts without being expected to go deeply into the complex physicochemical theories of the subject. Hitherto Sabatier's almost classic treatise has been the standard work on organic catalysts and therefore the appearance of G. G. Henderson's book will be greatly appreciated by English students, though no one, who can, should neglect to read Sabatier and so gain the inspiration contained in its pages.

Prof. Henderson describes in simple and straightforward language, such as will appeal particularly to all chemists engaged in industry, what has been already achieved in the application of catalytic reactions. No attempt is made to describe actual working processes or to draw comparisons between alternate methods, but the existing knowledge so far as it is available in published papers and patents, is dissected and summarised so that the reader with a minimum of effort can readily gain an insight into what has been accomplished in the field.

In dealing with the patent literature, though reference is in all cases given to the patent, the name of the patentee is omitted; many will regard this as a welcome improvement on the custom which has grown up during the last few years of labelling every process and piece of apparatus with a name, often without any regard to the true discoverer, if such a person can ever be said to exist in these days of gradual evolution.

Some of the most important applications of catalysis concern reactions between gases, which have the advantage, usually, that the formation of a large amount of bulky by-products is avoided and further that they can be effected in a compact and economically worked plant. Such, for example, is the elimination of carbon disulphide from coal gas achieved by Carpenter and Evans. The catalytic methods of production of ammonia from hydrogen and nitrogen and its oxidation to nitric acid are likewise far in advance of the old chemical processes though the former reaction has still to be worked out on the technical scale in Britain.

A large amount of the book is naturally devoted to hydrogenation, which still affords the example of the most successful application of catalysis in industry. The subject of fat hardening already has a literature of its own, but attention is directed in addition to a number of other reductions in which free hydrogen and a nickel catalyst are of service. Dehydrogenation also receives attention and is of growing technical importance—large quantities of aldehyde have been made from alcohol this way during the war; a brief section is devoted to catalytic oxidation, in which field the chief progress for the future is to be expected. Enough has been written to indicate the scope of the work and its value to the chemist.

Dr. Maxted's book is restricted in its scope to catalytic hydrogenation and reduction: it is one of the text books of chemical research and engineering edited by W. P. Dreaper. After dealing with the preparation of catalysts and the methods of affecting hydrogenation, the author discusses in turn the published work on the hydrogenation of unsaturated chains, unsaturated rings and miscellaneous reductions. The book is particularly clearly printed and the organic formulæ are a model of what such should be; this materially enhances the utility of the book. A final section is devoted to the technical hydrogenation of fats and oils.

PUBLICATIONS RECEIVED.

An Introduction to the Physics and Chemistry of Colloids. Text-Books of Chemical Research and Engineering. *By* E. Hatschek. *Third Edition. Pp.* 116. (*London: J. and A. Churchill.* 1919.) *Price 4s. 6d.*

The Manufacture of Aluminium. *By* J. T. Pattison. *Pp.* 104. (*London: E. and F. N. Spon. New York: Spon and Chamberlain.* 1918.) *Price 7s. 9d.*

Coal Tar and Some of its Products. Common Commodities and Industries. *By* A. R. Warnes. *Pp.* 105. (*London: Sir Isaac Pitman and Sons, Ltd.*) *Price 2s. 6d.*

Publications of the United States Geological Survey. Department of the Interior. (*Washington: Government Printing Office.* 1919.)

Quicksilver in 1916. *By* H. D. McCaskey.

Sand and Gravel in 1917. *By* R. W. Stone.

Cement in 1917. *By* E. F. Burchard. *With a Section on* Concrete Ships, *by* R. W. Lesley.

Sodium Salts in 1917. *By* R. C. Wells.

Gold, Silver, Copper, and Lead in South Dakota and Wyoming in 1917. *Mines Report. By* C. W. Henderson.

Gold, Silver, Copper, Lead, and Zinc in Utah in 1917. *By* V. C. Heikes.

Gold, Silver, Copper, Lead, and Zinc in California and Oregon in 1917. *Mines Report. By* C. G. Yale.

Gold, Silver, Copper, Lead, and Zinc in Nevada in 1917. *Mines Report. By* V. C. Heikes.

Gold, Silver, Copper, Lead and Zinc in Montana in 1917. *By* V. C. Heikes.

Secondary Metals in 1917. *By* J. P. Dunlop.

UNITY AMONGST THE TECHNICAL CHEMISTS OF THE EMPIRE.

Attention is drawn by the suggestions made in the topical address of Dr. Frank T. Shutt, as Chairman, to the Ottawa Branch of the Canadian Section of our Society, to the insistent problem of the collaboration and federation of technical chemists all over the British Empire, in the interests of industries throughout its scattered component countries. It is not a question of the furtherance merely of chemical industry proper, but of all industries in which chemistry and chemical products play a part. There is serious risk of waste and conflict of effort, with consequent postponement or dearth of results, if each country goes its own way in promoting advance in technical chemistry and progress in chemical industry. Dr. Shutt recognises to the full the advantages such a central organisation as the Society of Chemical Industry affords for collective effort and mutual support in the assembling of chemists for the discussion of chemical problems and their application to industry, and for the collection and dissemination of technical literature among the English speaking peoples. But we are not sure that the potentialities for good which the liberal and elastic constitution of our Society confers upon it are always and everywhere recognised by others —if they were more generally appreciated it seems unlikely that there would be so large a crop of distinct and specialised technical-scientific bodies, aiming chiefly at objects which could be more readily and effectively attained by Local Sections and Subject Groups of a well-established and representative body of wider scope.

The time is ripe for dwelling briefly upon the benefits which membership of our Society offers, not only to the isolated worker in applied chemistry in general, but to aggregations of chemists and the men who have specialised in particular applications of chemistry. First and foremost, they receive the Journal of the Society, which it cannot be gainsaid presents the most complete and concise continuous record in any language or country of literature relating to, and advances in, applied chemistry for thirty-seven years past. Other Societies have launched journals frankly imitative, but the Journal of the Society of Chemical Industry retains the predominance which is the meet reward of the pioneer. Last year witnessed an extension of the Journal, by the inclusion in its covers of a "Review" section, which has been well appreciated and is responsible for extended circulation of the Journal as a whole. The forthcoming developments in the aerial transport of important mail matter will greatly facilitate prompt publication and distribution of periodical technical literature from a few central sources. It will enable our Journal to print and publish the proceedings of its transatlantic and antipodean Sections almost as promptly as those of home Sections, and members will be thus kept in much closer touch than hitherto.

The approval by the Council of the formation of Subject Groups, of which a Chemical Engineering Group is the forerunner of others, affords an apt illustration of the flexibility of the Society's constitution; and the remarkable initial success of this Group in enrolling over 400 members within a very few months of its inception is a striking proof of the advantage accruing from connexion with a parent society which is able and willing to place its organisation at the disposal of a new body engendered within its fold. If it were more fully realised that it is open to Local Sections and Subject Groups to raise funds to supplement the grant they receive from the Society's general resources, by collecting contributions from the sectional or group membership for the purpose of circulating information of peculiar interest to the local or group members, there would be less talk of the formation of new technical societies *ad hoc*. The Council of our Society will give every encouragement to the formation of new Local Sections or Subject Groups, and to the issue of local or subject "Proceedings" supplementary to the Journal, merely avoiding as far as may be any clashing of activities with those of existing Sections or Groups. A healthy spirit of rivalry within the Society's walls will do no harm, whereas rivals growing up outside may impair the Society's power for good, and cannot be as useful to their members as can a Section or Group of this Society.

THE ORGANISATION OF CANADIAN CHEMISTS.*

FRANK T. SHUTT.

The organisation of Canadian chemists is probably the most important matter of a general character that could engage our attention at this time. Many of us are of the opinion that the time has fully come when, alike in the interests of ourselves and of our country, there should be a closer linking up of the chemists at work throughout the Dominion. We all recognise the basic character of the relation that exists between the science of chemistry and our national manufactures and industries, and we are firmly convinced of the vital importance of the application of chemistry to their development and welfare. The same is also true in respect to chemistry and our great natural resources: chemistry must play a very large and important part in their future economic development. Of agriculture, Canada's largest and most important industry, 30 years' experience has taught me that all true and permanent progress will be and must be based on scientific work and investigation, and that of all the sciences taking part in this work, chemistry is the one that above all others will and must take the first place. There is a great future for profound chemical investigatory work in agriculture; would that those in authority had the knowledge and foresight to realise it!

Whatever chemists and chemistry can do towards increasing the wealth and promoting the welfare and prosperity of the peoples of this Dominion can be done more effectively and more economically if the chemists of this country have organisation. Whether this work be of the nature of the working out and control of processes, general analysis or profound research, we feel confident that a closer organisation than now exists among Canadian chemists will conduce to greater progress and greater efficiency.

But before pursuing this subject I wish from common gratitude to pay a tribute of thanks to that splendid British organisation to which we in Canada owe so much—the Society of Chemical Industry—and to place on record an expression of our high appreciation of all that it has done for chemists in Canada. It is this society that enabled Canadian chemists to take the first step towards organisation. This is something to be thankful for, something that we ought never to forget. As you are aware, as long ago as 1902 branches of this Society were formed in Canada, and these have been in successful operation for a number of years. In this the Society has done a good work. It has helped us

* From the Chairman's Address to the Ottawa Branch of the Canadian Section, December 1918.

with prestige, it has helped us financially and it has offered us an avenue for the publication of our work in the columns of its journal. For all this we would like to convey to our parent society our grateful acknowledgments.

It may be found after a thorough consideration of the whole matter that this relationship, which in a measure gives us a fellowship with the chemists of the Empire, is too valuable a one to cast off. A consensus of opinion and an inventory of our strength and resources may show that it is impossible for Canadian chemists to stand alone, and if such be the case we must loyally and enthusiastically continue our work under the present auspices. No one will more heartily support the present arrangement than myself. It has worked satisfactorily in the past and it is quite possible it may meet our needs for the immediate future. We have however to recognise that there has been a growing feeling of late among the chemists of this country that our affiliation with the Society of Chemical Industry does not offer the very best form of organisation for Canadian chemists. At this juncture I wish to state very frankly that I to a very large degree share in the opinion that the time has come to strike out for ourselves and form a Dominion-wide society—a Canadian Institute of Chemistry or a Canadian Chemical Society. I will therefore place before you for your consideration and discussion the desirability of one organisation of chemists for Canada, with a constitution that would enable it to enrol all *bona fide* chemists in good repute from the Atlantic to the Pacific. First, there is the raising of the status of the Canadian chemist. It may well be asked if the Canadian chemist, unless he hold a professorial position at a university, has any recognised professional status in this country. It is very doubtful if he has. Most certainly he does not rank with members of the medical and legal and engineering professions. Let me cite one or two instances in support of this statement. A few years ago a well-known Canadian chemist holding an important and responsible position in the country was subpœnaed to give evidence in a case involving several millions of dollars. He prepared himself for the case, studying its various phases and aspects. He was on the stand for two days and his evidence covered many folios. He sent in an account for $200.00, which he thought a modest sum under the circumstances. The Court ruled that he was entitled to $4.00 a day and expenses, and that is all he received. That is an illustration of how the courts of the land view or estimate the professional status of the Canadian chemist. Another instance:—The Civil Service Commission is to-day advertising for a chemist who must be an honours graduate in chemistry of a recognised university with at least one year's experience in analytical work of a certain specialised character, and the salary offered is $1300 per annum! This is how our Government views the importance of the science of chemistry and the status of the profession. Do you think the Government would have advertised for a medical man or a lawyer or a qualified engineer at such a salary?—I think not.

Well, if these instances are fair and representative—and I could cite many more, bearing on the same point—as for instance when a Minister of the Crown wanted me, not so many years ago, to accept as chief assistant in our laboratories at the Experimental Farm a clerk in a drug store, not discerning the difference between the nature of the work of a drug store and that of a chemical research laboratory—what, I ask, can we do to raise the status of the chemist? We certainly ought to do something. I do not see that there is any possibility of any advance in that direction until we have a national society with high standards of membership—a society that by its very constitution, its standing in the professional world, could in time create and exert an influence throughout the length and breadth of the land.

Then again I think a national society of chemists of the nature I have indicated would be the very best protection the profession could have against the half educated, poorly equipped and often not over scrupulous chemist that is found practising, often for a reduced fee, in every country. We have them in Canada, and this country as well as its responsible chemists needs protection against them. Much money has been thrown away, as I very well know, on propositions floated on the strength of inaccurate and misleading analyses.

Secondly, a national society would create a strength and an influence that could be used as occasion dictated in matters of moment to the country and its best interest. Of course, I refer only to matters of wide importance and which by their nature fall within the province of chemists to advise or offer an opinion upon. There ought to be, and I am sure there are from time to time, questions upon which a corporate body of chemists could by public pronouncement and by memorials well advise our people and their legislators, as for instance in establishing standards of quality for all classes of manufactured and industrial products, and in the making of regulations which should safeguard the health of the workmen and the public generally. The industries look well after their own interests in such matters—that is true the world over—the public needs education and protection, and we as chemists have a responsibility in all this which we ought not to neglect or ignore. There is in this a national work to be done and it is only a national society that can do it.

Thirdly, a national society of high standing and with high ideals would act as a stimulus to more thorough, profound and careful work by our Canadian chemists. It would furnish an incentive for the best work. Without a due realisation of the high character of our work we become but drudges. Once chemistry is on a plane with the so-called learned professions, the best of our men, the ablest, at our Universities would enter it; for chemistry not only ranks with the most interesting and fascinating of all sciences but, as you will all admit, it offers problems and a field of research that call for the brightest intellects, the finest scholars the country can produce. Canada as she grows will need and must have more and more chemists, and chemists of the very highest ability; how else, I ask, is she to take a place in the front rank of civilised peoples?

Fourth, a national society would make possible a journal for the publication in Canada of Canadian work in pure and applied chemistry. This is something that we ought to have for our use and information and in order to take our rightful place among the progressive nations of the world. It is true we have a *Canadian Chemical Journal.* We are very glad to have it; it is proving an interesting and useful publication from several points of view; but its sphere is necessarily limited and it is not within its province to print papers on theoretical, abstract subjects and matters of pure research, of interest only to those who are engaged in or interested in the science of chemistry apart from its application. The only avenue for the issue of such papers at present in Canada is in the transactions of the Royal Society of Canada, and this avenue does not seem to have appealed to very many of our chemists, possibly because of the restricted distribution of the Transactions.

It is not necessary to enlarge upon the advantage of such a journal as I have spoken of. There ought to be a sufficiency of material to maintain a quarterly of high quality, and if at first there were a difficulty in getting papers of the right stamp,

surely the very existence of such a journal would be an incentive, especially to our younger chemists, to enter upon investigatory work, for publication in its columns. It would be a matter of pride to us and all Canadians to have a journal of purely Canadian work. Presumably, at first, it would be a very modest affair.

As to the constitution of such a national society of Canadian chemists, I will merely outline what might be desirable or possible. Briefly my idea would be a society that would include Fellows, Associates and, if found practicable, general members. It might be modelled after the Institute of Chemistry of Great Britain and Ireland and the recently formed Australian Chemical Institute, though I am of opinion that a Canadian society should be built upon a broader basis than either. The election of Fellows and Associates should be by examination or based upon chemical training, qualifications and experience of the candidate. Each election should be approved by the central Council of the society. A high standard should be insisted upon, so that the status of Fellowship and Associateship should be tantamount to and generally and professionally recognised as equivalent to chemical degrees. The society should not be restricted in its function to registration, as, for instance, is the Institute of Chemistry in Great Britain. It should be a society that would bring its membership together for the reading of papers, for lectures and discussions on chemical matters generally, in as many branches as may be deemed necessary or desirable at centres throughout the Dominion. I am aware of the difficulties that would be met in establishing and maintaining a society which included the professional and non-professional member. Whether these difficulties are insuperable I cannot say. If it were possible I should like to see those interested in chemistry, but not professional chemists, find a place in the society.

The society would be governed by a council elected annually by the Fellows and Associates and meeting say three or four times in the year for business at headquarters, or at one or other of the large cities, as might be determined upon. The society would necessarily have its charter Fellows, and Associates, elected, say, during the first year of its existence and drawn from the ranks of Canadian university professoriate, from the ranks of Government practising and industrial chemists, etc. The Committee on Constitution could make out a list of good men for consideration of the Council. The fees of course would be graded and each branch would have its own local officers. The society would undoubtedly require some financial assistance on the part of the Government, if it were to support a journal. If it could be shown that the society was really a good thing for Canada such assistance should not be very difficult to obtain, and I think it could be demonstrated that a national society of chemists would prove a very valuable institution, not merely for the profession but for the country at large.

In discussing the more important and salient features of the establishment of a purely national society of Canadian chemists, it is not my desire in the least to impose my views upon you; but I trust that my remarks may be of assistance in leading our discussion into definite lines.*

* At the close of the meeting a resolution was passed to the effect that the work of organising Canadian chemists could be best undertaken by a new and separate institution.]

NOTICE.—*Opinions expressed in articles, etc., bearing the name of the author, are not necessarily those of the Council of the Society, or of those more immediately responsible for the publication of the Journal. The insertion of such articles, etc., means simply that the subject matter or the point of view taken is of sufficient interest or importance to warrant publicity.*

REVIVAL OF INDIGO.

In addressing the Textile Institute, at Bradford, on February 27, on this subject, Prof. H. E. Armstrong took exception to the application of the adjective *natural* to indigo as redundant, also to the use of the expression *synthetic indigo*—as indigo never has been and never can be made artificially. Indigo is a mixed material, produced in a particular way from a plant, containing, in the case of well-made samples, about 70 per cent. of the specific compound *indigotin*. This compound, not indigo, is the substance which is being manufactured and sold in an almost pure form. The term indigo should be used only in speaking of the natural product.

Indigo contains substances other than indigotin which have an influence in the dye vat, even if not actually dyestuffs. It has been the studied policy of the German manufacturers to disregard these associated materials as of no account; all but the old conservative school of dyers have fallen into the trap; these latter have always maintained that indigo has special qualities, which give it an advantage, in dyeing heavy shades, over manufactured indigotin pure and simple. Probably, in future, this difference will be one of determining influence on the industry.

In trials made with special care to contrast indigo with synthetic indigotin, in dyeing heavy shades on loose wool, the former has been found to have the advantage to a very marked extent. Hydrosulphite vats (1500 gallons) were set with equal quantities of indigo and of synthetic indigotin paste, each containing 20 per cent. indigotin, and equal quantities of loose wool were dyed simultaneously in the two vats in lots of 50 lb. at a time. In the case of the first 2 or 3 dyeings, deeper shades were obtained in the indigo vat: in consequence, the addition of paste before dyeing each lot of wool was gradually reduced, and it was eventually found that equal depths of shade were produced when the amount supplied each time was 8 lb. of synthetic paste and only $6\frac{1}{2}$ lb. indigo. Indigo produces a rather redder and brighter shade even when these proportions are used. The difference is being made the subject of systematic inquiry.

After considering the history of the introduction of synthetic indigotin and the position of indigo prior to the war, especially the great reduction in output of the natural product, Prof. Armstrong gave an account of the efforts made to improve the industry in India, in particular of late in Bihar, under the direction of Mr. W. A. Davis. It has been shown conclusively that a paste containing a standard proportion of indigotin, comparable with that in the synthetic paste on the market, is easily prepared, and that the only disadvantage it has arises from the presence of a certain proportion of insoluble matter. An organisation for the preparation of such paste has been established, and probably this material will be put on the market in competition with synthetic paste. Other forms, more easily transported, are in contemplation, however.

The process of manufacturing indigo has been much improved under Mr. Davis' direction—in particular the yield has been raised considerably by the recovery from the "seet" water of the finely divided, suspended indigo, which formerly ran to waste: this has been effected by adding Dhak gum.

The extraction process is being studied in every particular, especially on the bacterial side.

The crop has been a declining one of late years, owing to the diminished yield per acre, the occur-

rence of wilt disease and the attack of the plant by an insect pest; also by reason of the difficulty of raising seed. A careful and extended survey of the results has led Mr. Davis to the conclusion that, at all events, the main cause of the decline is the depletion of the soils in available phosphate. Of late, even the Natal-Java plant has ceased to give a superior yield—the early success of this variety is shown to have been due to the fact that it is a very deep rooted plant and was able to appropriate from the subsoil the phosphatic supplies beyond the reach of the Sumatrana plant.

The future of the industry appears to be mainly contingent on the extent to which planters are able to apply phosphatic manures. Apart from the dyestuff it yields, the indigo plant is now of importance as a green manure; and as a leguminous crop it also has its definite, natural place in the rotation. It is clear that big crops can be obtained, if proper agricultural conditions be secured, and that there will be no difficulty in raising seed. There is also reason to believe that improved varieties of the plant, giving an enhanced yield of indigo, will soon be produced. In short, improvements are foreshadowed in many directions, so that indigo may well recover its position and enter into effective competition with the artificially made somewhat imperfect substitute.

PATENT LAW REFORM.

A. RÉE.

The Memorandum on Patent Law Amendment issued by the Institute of Electrical Engineers* is a document which should be read by everyone interested in the subject. A great deal of the matter incorporated in it is of a controversial nature, and, in particular, some of the recommendations (see this issue, p. 127R) cannot be regarded as other than harmful to the interests of British chemical manufacturers.

The question of a patents moratorium is dealt with at some length, but it appears doubtful if the recommendations under this head will be adopted, for although they would certainly benefit patentees, they would inflict grave injustice in many cases. In regard to compulsory licences, and the working of patented inventions, the Memorandum presents the case of those who have always been bitterly opposed to these measures, and it is lamentable that an agitation so fatal to the best interests of British chemical industry should be set afoot again, led primarily and almost exclusively by engineers whose interests in Patent Law affairs are so diametrically opposed to those of chemical manufacturers. It does not appear reasonable to recapitulate here in detail the case in favour of compulsory licences, or working, for it has been so often and convincingly stated that anyone interested can at once put his hand on various articles and pamphlets dealing with this part of the subject.

The question of patentability of articles for food and for medicinal purposes was probably introduced into the 1917 Bill (Clause 11, Section 28) in order to make our law conform to that of France. There is little doubt that this clause will not appear in the new Bill that is being drafted, or at all events, it will be framed on entirely different lines. It must, however, be strongly emphasised that product patents should be abolished, except with the modification recommended by the Manchester Chamber of Commerce, as well as by the Association of British Chemical Manufacturers. Germany has benefited enormously in the past by not having product patents herself, but by being able to secure them in certain other countries, such as England, France, and Italy. The last two countries are for that reason doing away with product patents, having fully recognised how, in this respect as well as in many others, their patent laws have helped German industry and damaged their own. It might be interesting in this connection to give the actual wording of the recommendations of the Manchester Chamber of Commerce and the Association of British Chemical Manufacturers:—"That there should be embodied in the Bill a definition of 'invention' in substitution for that in the existing Act, such definition to include chemical processes and the products of such processes, no patent to be granted for the products apart from the process or means by which it is produced. Subject to this limitation the field of invention should be absolutely free and unrestricted." It might also be interesting to quote the following recommendation by the above-mentioned bodies:—"With regard to patents for inventions relating to articles or substances for food or drink, or for medicinal or surgical purposes, or to methods or processes for manufacturing such articles or substances, power should be given to the Comptroller to prevent any abuse of the monopoly granted, with a view to making the patented invention available to the public at a reasonable price."

Certain recommendations are made in this pamphlet extending both the provisional term and the term for acceptance of complete specification. It is suggested that what is wanted is an extension of the term of priority under the International Convention. The great difficulty is in getting the English application through in the twelve months allowed by the International Convention. Very often, if the inventor exercises his full privilege of waiting six months before filing his complete specification, he may have reached the limit of the twelve months that are allowed before the complete specification is in order for acceptance in this country. The suggestion, contained in the Memorandum, to extend the period to nine months instead of six months as heretofore, would only aggravate the situation. It is true that this objection is said to be met by a proposal that a patentee should file his patent of origin elsewhere than in England; but this would prevent him from manufacturing at once in England, and if the patentee should have failed to secure protection in the foreign country where (under these proposals) he first applied, his position would be a most unenviable one. Further, every one, quite naturally, wants to produce first of all in his own country; and it should surely be obvious that the country or origin ought to be the country in which the invention was really originally made.

The suggestion of constituting a new tribunal to try cases involving scientific and technical questions will meet with general approval and acceptance. We should like, however, to point out that such a proposal emanated originally from the Manchester Chamber of Commerce, was adopted by the Association of British Chemical Manufacturers, and reads as follows:—"All orders of the Comptroller (under Clause 1, Sub-section 12) shall be subject to the appeal to the Court, and it is recommended that a Court of say five members, two legal and three technical, should be constituted, and that three members, one legal and two technical, should form a quorum."

At present appeals lie with the Officers of the Crown, except in those cases where they are referred to the High Court. The principal reason why various bodies are suggesting a special court composed of experts is that the Law Officers are

* Memorandum on Patent Law Amendment, based on a Report prepared by the Institution of Electrical Engineers and put at the disposal of the Technical Institutions' Conference by that Institution, Oct. 10, 1918.

extremely busy men, and hence appeals to them entail great delay, sometimes over 12 months, and cause patentees to incur risks and very considerable expense. Were such a new special Court created, it would be desirable that every variety of case should be referred to it, *i.e.*, not only those which lie with the Law Officers of the Crown or the High Court, but also any kind of patent litigation, and appeals arising in practice from the opposing of the grant of a patent, disclaiming, etc. Such a proposal, which involves a purely administrative matter, would have to be dealt with by the House of Commons.

NEWS FROM THE SECTIONS.

CANADIAN PACIFIC.

At the meeting held on January 10 at Vancouver, B.C., Mr. W. S. Barwick, of the Vancouver Engineering Works, read a paper on "Ferro-Alloys and the Hardening of Steel."

Mr. Barwick described the various ills that affect steel and iron during manufacture, their causes and the methods developed by metallurgical chemists in overcoming them. The production of ferro-alloys has evolved with the developments of the electric furnace. Ferro-alloys often not only act as cleansing agent by removing undesirable constituents such as oxygen, nitrogen, sulphur, but also impart very desirable properties to the product. A very complete description of the various types of steel was given, and special reference was made to the very considerable economy effected during the war by the use of certain ferro-alloys.

On February 24, Prof. E. H. Archibald, of the University of British Columbia, addressed the Section on "The Rusting of Iron."

The author reviewed the theories advanced to explain the phenomena of rusting and described experiments that had been made to substantiate them. The varying conditions in nature causing rust and methods of protection or prevention were reviewed, such as the solubility of oxygen and atmospheric impurities in water, depth of immersion in water, porosity of iron under normal conditions and under deformation, intensity of light, and the action of films of fatty or hydrocarbon oils on the surface of water or on the iron. The presence of rust accelerates corrosion owing to absorption of moisture by the rusted areas. Hence the rails of railroads rust more rapidly when not in use. The corrosion of cans coated with a film of linseed oil and baked at 150° C., is due to the oil combining with either oxygen or hydrogen and thus reducing the protection due to polarity. By baking at 250° C., better results have been attained.

Prof. Archibald favoured the electrolytic theory as the best explanation of most of the phenomena associated with the rusting of iron. After the address, he demonstrated experimentally the varying local composition of commercial iron. A small bar of polished iron immersed in distilled water containing phenol phthalin exhibited local areas of red over the cathode portions. The anodic areas may be demonstrated by the addition of potassium ferricyanide when the ferrous iron forms Turnbull's blue. A bar of chemically pure iron would not show areas of local polarity.

Mr. J. A. Dawson, chairman, reported on the progress made in organising a federation of technologists under the provisional title of the United Professional Engineers of British Columbia. It was hoped that through this organisation of architects, engineers, chemists, and other technologists, there would eventually develop co-operation as to programmes, club rooms, libraries, as well as the immediate aim of professional protection, including protection to the public as a result of the legislative definition of these professions.

CANADA.

Ottawa.

The third ordinary meeting of the Ottawa Branch was held on February 20, when an address was given by Mr. S. J. Cook, the local secretary, on the subject of "Paint Pigments: Their History and Development." Mr. Cook treated the subject briefly from a historical point of view and then, after offering a classification of the various pigments as they occur in commerce, proceeded to discuss particularly the white pigments and inert fillers. The Society was honoured on this occasion by a visit from the chairman of the Canadian Section, Dr. W. L. Goodwin, of Queen's University.

A special motion-picture meeting of the Society was held on February 6 in the Exhibits and Publicity Branch of the Trade and Commerce, Ottawa, at which about forty members and guests were present. Through the courtesy of the American Cyanamide Co., films portraying the processes in use at its Niagara Falls plant were shown. Dr. Shutt, in a few introductory remarks, traced the development of the various processes for the fixation of atmospheric nitrogen and discussed the importance of the nitrogen compounds to the vegetable and animal worlds; he also touched upon the uses of cyanamide as a fertiliser and as a source of nitric acid and ammonia. Films were also shown illustrating the manufacture of pottery and the construction of wooden ships in Canada.

NOTTINGHAM.

The annual meeting of the Section was held at University College on March 19. Prof. J. W. Hinchley first gave a paper on the aims of the Chemical Engineering Group. In the discussion which followed, officials and members of the Society expressed their approval of the objects of the Group as stated.

The Annual Report was then read; it showed a year successful from the point of view both of papers and discussions and also from that of membership. There are now 170 members, which is a net increase of 40 over last year's total. The number of nominations of officers and committee for the next session being equal to the number of vacancies, the following were declared elected:—

Chairman, Mr. F. H. Carr; Vice-Chairmen, Dr. S. R. Trotman and Mr. J. White; Hon. Treasurer, Mr. S. J. Pentecost; Hon. Sec., Mr. J. M. Wilkie; Committee—Prof. F. S. Kipping, Dr. O. E. Mott, Messrs. L. Archbutt, J. F. Briggs, S. F. Burford, B. Collitt, R. Duncalfe, J. H. Dunford, J. Marshall, W. P. Skertchley, G. J. Ward, and J. T. Wood.

BRISTOL.

The second annual meeting was held on March 27 at the University. Dr. Butler, the chairman, in the course of his address, referred to the success of the Society's annual meeting held in Bristol last year, and to the papers which had been read before the Section during the past session. The membership has increased to 152. The resignation of the Hon. Secretary, Mr. R. F. Easton, has been accepted with regret, and most of the initial success of the Section was due to the energy he displayed. Mr. Easton was presented with a silver cigarette box by the members of the Committee in recognition of his good services. After a vote of thanks had been passed to the University authority for facilities granted, the meeting proceeded to the election of officers for the coming session. These were

elected as follows:—Chairman: Mr. E. Walls; Vice-Chairman, Mr. W. R. Bird; Hon. Treas., Mr. J. Bernard; Hon. Sec., Dr. F. Rixon. Committee: Professors F. Francis, C. M. Thompson, Dr. Butler, and Messrs. E. C. Evans, E. F. Hooper, C. J. Waterfall, J. M. Dodds, C. E. Boucher, L. J. Davies, G. H. Hedley, M. W. Jones, and W. J. Cooper.

Mr. F. J. Popham then read a paper on "Peat," in which he pointed out that the world's resources of it were enormous, and its exploitation from the standpoint of fuel conservation was very important. He referred to the use of air-dried peat in producers, with ammonia recovery, and the principles underlying the so-called "wet-carbonising" process for the preparation of fuel briquettes from peat. He considered that the chief difficulties in the application of this process were of an engineering character, and not fundamental.

LIVERPOOL.

"Pulverised Fuel" was the subject of the paper read by Mr. A. Grounds to the meeting held at the University on March 21. The chair was taken by Mr. A. T. Smith. This question has received but scant attention in this country, except by the manufacturers of Portland cement and the inventors of the Bettington boiler, with the result that many English firms are now paying royalties to American patentees.

The efficiency of combustion of raw coal cannot compare with that of the pulverised material, and with regard to cost, it has been calculated from average data that the B.Th.U.'s delivered to the furnace per penny cost of operation are as follows: Fuel oil, 25,300; water gas, 28,700; powdered coal (screw conveyor system), 32,500; powdered coal (pneumatic system), 42,488. It is true that the increased cost of drying and grinding has to be set against increased efficiency and economy in fuel, but no heat is utilised in evaporating moisture from the coal inside the furnace, as is the case with the raw coal fired furnace. The objection as to scattering of the ash has no foundation, as, on the contrary, it slags and forms either a pool on the floor of the furnace or a troublesome deposit on the walls and tubes. It is false economy to use coal of too low a grade; the most suitable material is one containing less than 1 per cent. of moisture and more than 30 per cent. of volatile matter, although a fairly wide range of coals can be used.

The fuel is given a preliminary crushing, with magnetic separation of admixed iron and steel fragments, dried in a rotary dryer, and then finely pulverised in one of the various types of grinding machines (Krupp, Huntingdon, Bradley, Carr, Bonnot). The powdered coal is carried either by screw-conveyor, or pneumatic system, to the burners. In the Holbeck system, now coming into extensive use, the powdered fuel is fed into a storage-bin and from this into a high-pressure blower, which forces it into the distributing main—a wide pipe from which it is tapped off to the various furnaces. The supply of dust is made automatic; auxiliary blowers and boosters can be placed in line to assist circulation. Among the advantages of this system are: (1) The air used for conveying coal dust is also used for combustion; (2) high cost of repairs for screw-conveyors is eliminated; (3) the need for a bin at each furnace is obviated; (4) a few minutes after the furnaces are shut off all coal dust in the system is returned to the pulverising plant, thus leaving no coal dust in storage in the works or at the furnaces. Great economy is effected by preheating the air, and wear and tear on furnace lining is reduced by water-cooling, by reduction of air pressure, and avoiding sudden changes in direction of flow of gases.

THE CHEMICAL SOCIETY.

ANNIVERSARY DINNER.

After an interval of six years, the anniversary dinner was revived on March 27 last, the President, Sir W. J. Pope, presiding. The attendance beat all previous records, over 360 Fellows and guests being present. Among the latter were the Rt. Hon. Lord Moulton, the Rt. Hon. H. A. L. Fisher, President of the Board of Education, the Rt. Hon. Sir Alfred Mond, First Commissioner of Works, Sir J. J. Thomson, President of the Royal Society, Dr. C. Poulenc, President of the Société Chimique de France, Sir Aston Webb, President of the Royal Academy, and representatives of other leading learned societies.

Lord Moulton, who gave the toast of the Chemical Society, spoke of the great part played by chemistry in the war. There is no doubt, he said, that the Germans held their hand until their great installations for producing ammonia by the Haber process were completed. They looked to their large chemical factories for the manufacture of ammunitions, and they relied on the potency of their poison gases. These things, together with the great advance they had made in artillery, emboldened them to anticipate a rapid victory. The struggle was really one in which each nation depended on its chemists. When he first took up the supply of explosives in November, 1914, England was practically destitute of factories which could be turned to warlike purposes, she was entirely destitute of any home source of nitric acid or nitrates, and was possessed of no plant for producing lethal gases. The way in which our chemists responded was marvellous, and except for a temporary inferiority in regard to the supply of "mustard" gas, it could truthfully be said that from end to end of the line we were at least equal to the enemy in all branches of chemistry as applied to warfare. Time and again when we appeared to be at the limit of our resources, some new method of increasing production, some new process, or some variation in an old process was devised to meet the occasion. Both England and Germany have learned that their natural resources are much wider than they were thought to be, and there seemed to be no limit to be set upon the possible achievements of chemistry and physics working hand-in-hand. In coupling the name of the President with that of the Society, Lord Moulton spoke in eulogistic terms of the excellent work he had rendered to the country in problems connected with poison gases, and in the more polite realm of aerial photography.

In the course of his reply, Sir W. Pope said that the nation must be prepared to pour out treasure into our educational establishments for securing the potential young energy of the country and directing it into scientific channels. It is, further, essential that money should be poured into our universities for the purpose of stimulating research and of acquiring a tremendous output of scientific knowledge; whether that knowledge be "pure" or "applied" did not matter, the return in any case would be enormous.

The toast of His Majesty's Forces was then given by the President, and responded to by Lieut.-General Sir William T. Furse.

The toast, "Our French Colleagues," was proposed by Prof. H. E. Armstrong, who said that this was the first occasion upon which the French society was officially represented at their anniversary meeting. In felicitous terms he quoted Wurtz' dictum, "La chimie est une science française, elle fut fondée par Lavoisier d'immortelle mémoire," and referred to the long list of distinguished French

chemists who had advanced the science. After Dr. C. Poulenc had replied, Sir J. J. Dobbie proposed the toast of the guests, coupled with the names of the Rt. Hon. H. A. L. Fisher, Sir Aston Webb and Sir J. J. Thomson. Mr. Fisher humorously referring to chemists as past masters in the fine art of murder, deplored that he was but a melancholy product of the dark ages of compulsory Greek. The educational cause which Huxley championed may now be regarded as practically won, and former sceptics must have been converted by the achievements of science in the war; there was, however, leeway to be made up and a great deal more money must be spent on science. If warfare is to be a thing of the past, chemistry will be the principal agent of that beneficent change. It will have done more than any League of Nations can possibly aspire to do. We realised, he hoped, that the best form of protection for national industry was not more tariff, but more chemistry. It is necessary to create in the whole country a general atmosphere of mind favourable to scientific ideas. Thirty years hence, when the educational changes which had recently been introduced had had time to bear full fruit, his successor at the Board of Education would have no reason to complain of the neglect of science.

Sir Aston Webb and Sir J. J. Thomson also responded.

MEETINGS OF OTHER SOCIETIES.

MINERALOGICAL SOCIETY.

Sir Wm. P. Beale, Bt., president, occupied the chair at the meeting held on March 18. After Mr. L. J. Spencer had read a contribution on "Curvature in Crystals," Lieut. A. B. Edge described the "Siliceous Sinter from Lustleigh, Devon." The district round Lustleigh, near Bovey Tracey, is mined on a small scale for a very fine quality of micaceous hematite, which occurs there in well-defined lodes traversing the granite. At the Plumley Mine (now disused), on the walls of one of these lodes is found a peculiar banded material, which on analysis proved to be a siliceous sinter or opal of sp. gr. 1·73, with an approximate percentage composition of, silica 70, water 21, hematite 6, alumina, soda and potash 3. It is hard and compact, shows a beautifully banded structure, but is very fragile, breaking conchoidally even when most carefully handled.

A note on "An Anorthic Metasilicate from Acid Steel Furnace Slags," by Mr. A. F. Hallimond, was followed by a description of the meteorites from Adare and Ensisheim by Dr. G. T. Prior. The percentage amounts of nickeliferous iron and the ratios of iron to nickel support the view that in chondritic meteorites the quantity of nickeliferous iron present varies inversely with the nickel content. Dr. G. F. Herbert Smith described a students' goniometer, made by Messrs. J. H. Steward, Ltd. This instrument is of the type in which the direction of reference is given by the reflexion of some distant object in a mirror, and in which the axis of the graduated circle is horizontal. A ball and socket joint provides the mirror with all the necessary adjustments in direction, and it is also movable vertically in the plane of the axis of the circle. The crystal holder is provided with a simple form of adjustment which enables a crystal to be measured, as regards one half, without removal from the wax. A pointer on a swinging arm facilitates the setting of the crystal in the axis of the circle.

SOCIETY OF GLASS TECHNOLOGY.

On March 19, a meeting was held in the University, Birmingham, when a paper was read by Mr. B. J. Allen on "The Preparation of Raw Materials for, and the Casting of, Glass Pots."

The author first dealt with the deflocculation of clays, and showed it could be accomplished by electrical treatment. He described a simple apparatus for testing clays to show their suitability under this electrical treatment, and his experiments proved that many common fireclays altogether unsuited in their ordinary state for the manufacture of refractories could by the above treatment be made to produce a large proportion of highly satisfactory material fit to meet the specification for high grade work.

Mr. Allen dealt briefly with the manufacture of pots by the old method of building by hand, and referred to the limitations of this method. It is most difficult for the pot maker to guarantee a perfectly united homogeneous pot. It is very essential that clay and the grog be in intimate contact in the finished pot, and this is ensured by the casting of the pot. He then described in detail the preparation of slip and subsequent casting of pots. The lecturer expressed the opinion that research on all these matters should be carried out by the Society.

THE INSTITUTE OF METALS.

The spring meeting of the Institute of Metals was held in the rooms of the Chemical Society on March 25 and 26. The principal paper for discussion was the Fourth Report to the Corrosion Committee, by Drs. Bengough and Hudson, a lengthy document of 182 pages and 24 plates, embodying the results of a very long series of experiments and observations. The report differs from its predecessors in regard to the experimental method adopted, microscopical studies of the appearance of corroding surfaces taking the place of measurements of the loss of weight during corrosion. Some of the facts so recorded are very remarkable, and exceedingly difficult to interpret. The authors prefer the hypothesis of direct oxidation of metals to that of electrolytic solution followed by oxidation of the residual metal, but do not commit themselves to a definite theory of corrosion. On the practical side, they have added to our knowledge of corrosion under service conditions by their proof of the importance of the copper-rich surface layer on brass condenser tubes as ordinarily manufactured in determining their resistance to corrosive influences. They have also reached certain definite conclusions as to the limitations of the protection of tubes by the application of an external electromotive force.

Dr. Rosenhain and Mr. Hanson described the properties of some copper alloys which had been tested for special purposes, the chief interest of the paper lying in the method adopted to obtain sound castings by filling the mould under pressure. A lively discussion followed the communication of a note by Lieut.-Col. Jenkin, in which it was pointed out that there is at present little correspondence between the information required by the engineer as to the properties of the materials with which he has to work and that supplied by the metallurgist. The engineer wishes to know the endurance of steel or non-ferrous alloys under stress, their resistance to corrosion, etc., and is supplied instead with notes of micro-structure, Brinell hardness, Izod figure, etc., the exact relation of which to the data desired is unknown. In fact, the engineer and the metallurgist too often speak two different languages. There was some difference of opinion as to which of the parties should be responsible for the choice of the testing

methods, but the suggestion of Dr. Rosenhain, that the solution would probably be found in the determination of fundamental physical constants (specific heat, compressibility, etc.) and the establishment of definite relations between these and the working properties, seemed to be generally acceptable. The testing of materials has evidently to make a great advance before such a solution becomes practicable.

The second day's papers included several of practical interest. Messrs. Hanson and Archbutt described the micrographic constituents of light aluminium alloys, and showed how the compounds with copper, nickel, and iron may be distinguished from one another and from silicon. Two papers, by Messrs. Ellis and Johnson respectively, were suggested by the results of Mr. Alkins at the last meeting, and aimed at establishing a discontinuity in the change of mechanical properties of copper and brass with progressive cold work. It is evident, however, that much more exact determinations will be required before any speculation as to the causes of such a discontinuity can be more than guesswork. Some very interesting facts known to sheet rollers and tube drawers were brought out in the discussion, indicating a strongly marked time effect in the change of elasticity in cold-worked metals. This time factor has to be taken into account in any study of deformation by cold-working.

The final session was devoted to a general discussion on the relations of scientific research to works practice, the opener, Dr. Rosenhain, dealing with the general question, while Messrs. Barclay and Lantsberry dealt, from different points of view, with the organisation and functions of works laboratories. The remarks made by prominent manufacturers showed a keen appreciation of the services of science, and it is to be hoped that the newly established Non-Ferrous Metals Research Association, to which reference was made, will make a successful beginning and meet with adequate support. The veil of secrecy which has so long enveloped the non-ferrous metal industries is gradually disappearing, and it is to be hoped that the free interchange of information, which has rendered such great service in the manufacture of iron and steel, will become common in the sister group of industries.

THE CHEMICAL SOCIETY.

The annual general meeting was held at Burlington House on March 27. The report of the Council and the statement of accounts and balance sheet were adopted, and Sir W. J. Pope delivered the presidential address, which dealt principally with the achievements of chemistry in relation to the war. A report of the address will appear in an early issue of this Journal. The election of officers then followed, involving the following changes:—President, Sir J. J. Dobbie; Vice-Presidents, Sir W. J. Pope, Dr. H. J. H. Fenton, Prof. J. Walker; Council: Prof. F. E. Francis, Mr. J. A. Gardner, Dr. C. A. Keane, and Sir R. Robertson. The Anniversary Dinner was held the same evening.

At an ordinary meeting held on April 10, the President announced that the Society's Library would be open until 9 P.M. on every evening of the week, except Saturdays, as from May 1 next.

Reflux Condensers from Broken Glass.—Mr. N. A. Masani, chief chemist to the Morarji Goculdas Laboratory, Bombay, in a communication concerning the shortage of chemical glassware in India, states that an accumulation of broken test-tubes suggested to him their utilisation in the construction of the jackets of small reflux condensers, ordinary glass tubing serving for the inner parts. The improvised apparatus proved very successful.

NEWS AND NOTES.

CANADA.

Convention of Canadian Chemists.—The second convention of Canadian chemists will be held in Montreal during the last week in May. At this meeting it is expected that a purely Canadian society of professional chemists will be organised. The feeling is that no existing body is exactly suited to the task of drawing together into one organisation the chemists now scattered throughout Canadian universities and industries.

The Canadian Mining Institute.—On March 5, the Canadian Mining Institute held its twenty-first annual meeting at Montreal. Some thirty papers were given covering the latest activities in Canadian mining industries. Both in Quebec and Manitoba new resources of great value are being opened up. In Gaspé Peninsula, Quebec, deposits of zinc and lead are receiving attention, and the copper deposits of Northern Manitoba have been found to be exceedingly rich.

Ontario Mineral Production in 1918.—The Ontario Department of Mines has just issued its preliminary report for the year 1918. Values have greatly increased, both in metallic and non-metallic products. Compared with 1917 production shows a falling off in some items, but increased prices much more than counterbalanced diminished outputs.

The total mineral production for the year amounted to $80,000,000, being a net increase over 1917 of $8,000,000. This is the highest mark yet set, and Ontario now furnishes nearly 50 per cent. of the total mineral output of the Dominion. During the year the International Nickel Co. of Canada took over the business of the Canadian Copper Company, and in its new refinery at Port Colborne treated 5334 tons of nickel-copper matte, from the time the plant started in July. Although comparatively little iron is produced, the output of steel is valued at $28,792,361. Electric furnace developments were greatly accelerated and various ferro-alloys were turned out in large quantities. The three silver refineries situated at Delora, Thorold and Welland treated 8354 tons of concentrates and residues. The new Mosa oil field in Middlesex county contributed 108,998 barrels, or 37 per cent. of the total output. The production of crude petroleum is, therefore, on the increase. The output of natural gas decreased greatly during the year owing to the action of the Ontario Legislature in conserving the supply for domestic purposes.

BRITISH INDIA.

Importation of Calcium Carbide.—The Department of Statistics publishes the statement that of the 23,320 cwt. of calcium carbide imported into India during the last three months of 1918, Japan sent 21,700 cwt. and the United Kingdom only 33 cwt. Java contributed 887 cwt. and the United States 500 cwt.

Coal.—Over 18¼ million tons of coal was mined during 1917, and the value at the pit's mouth was 4*s*. 11*d*. per ton, as compared with the lowest, 3*s*. 4*d*., in 1905, and the highest, 5*s*. 3*d*., in 1908. The quality of Indian coal is very inferior to that of British coal, and it is very difficult to obtain material suitable for metallurgical purposes. The low cost of production is due to cheap labour and to the fact that the coal is very near the surface. Of the total production, 31·5 per cent. is used on the railways, and in 1917 the paper mills consumed 170,000 tons, the oil mills 160,000, gold mines 84,000, sugar factories 77,000, and gas works 63,000 tons. The demand for coal is great and the supply

inadequate. One of the serious problems to be faced is the provision of coal suitable for the metallurgical and chemical industries.

AUSTRALIA.

The Sugar Industry.—A Royal Commission, consisting of Messrs. A. B. Piddington, N. C. Lockyer and S. Mills, has been constituted to report on the sugar industry. The inquiry will cover the national value of the industry, production, Government control, Protection and Imperial Preference.—(*Official.*)

Immediate Policy of the Commonwealth.—Speaking at the Victoria Chamber of Manufacturers on March 27, Mr. Watt, Acting Prime Minister, said that the Federal Parliament would meet as soon as possible to deal with the tariff question. The Prime Minister, Mr. Hughes, is in Paris contending for three principles: (1) to obtain for the Commonwealth the control of the former German colonies in the Western Pacific; (2) to obtain for Australia an indemnity from Germany to defray some of the cost of the war; and (3) to secure fiscal freedom for the Commonwealth.—(*Official.*)

UNITED STATES.

Charcoal for Gas Masks.—The best raw material for gas mask carbon is coconut shells, which must be broken to a certain size and sifted to take out dust and fine particles. This new class of work was taken up by the Astoria Light, Heat and Power Company, which provided for storing 5,000 tons of raw material under cover and 15,000 tons in the open. As the supply of coconuts decreased, large quantities of cahune nuts were imported from British Honduras. The cracking and removal of the kernels required special machinery, which was soon provided. A call was made to the public for fruit stones, and many tons of peach, apricot, and prune stones were sent to the Astoria works from the Pacific coast. Also large quantities were obtained from thousands of barrels placed in the streets of New York for their reception. Ninety per cent. of the material used for masks made in the U.S. was carbonised at Astoria.—(*Amer. Gas Eng. J., Jan.* 18, 1919.)

GENERAL.

Annual Meeting of the Society.—The Council of the Society has accepted the invitation of the London Section to hold its annual meeting in London on July 15, 16, 17, and 18 next. Every advantage will be taken of the opportunity and of the locality to provide a programme worthy of the occasion, and to bring together an assembly commensurate with the degree of importance which the chemical industries have attained in the national life. It is also hoped that representatives of French chemistry and chemical industry will be able to attend.

His Majesty the King has graciously consented to act as Patron and H.R.H. the Prince of Wales as Vice-Patron. A General Committee is being formed to include some of the foremost representatives of science and industry; and amongst those who have already promised to serve upon it are the Rt. Hon. the Lord Mayor, the Rt. Hon. the Marquess of Crewe, Sir George Beilby, Sir J. J. Dobbie. Sir R. T. Glazebrook, Sir Robert Hadfield, Sir Herbert Jackson, Sir Alfred Keogh, Col. Sir Frederick Nathan, Sir W J. Pope, Sir Boverton Redwood, Sir T. K. Rose and Sir William Tilden. Sir William Crookes had also expressed his willingness to serve.

The opening meeting will be held at the Mansion House on July 15, when the Rt. Hon. the Lord Mayor will extend the civic welcome, and Prof. H. Louis will deliver his presidential address. Further particulars will be announced in due course, but it may be mentioned that arrangements have been made for the delivery of an address by Sir William J. Pope, for the holding of conferences on Empire sugar production, and on the leather, dye, and fermentation industries. Also, the Chemical Engineering Group will make its *début* with a whole-day conference on "Power Plants in Chemical Works." The lighter and more convivial side of the meeting will be provided for by a luncheon given by the London Section, the Annual Dinner, a soirée at the Imperial College, a smoking concert, and a whole-day excursion to Windsor. All communications in regard to the meeting should be addressed to Dr. Stephen Miall, at the Society's Offices.

Chemical Engineering.—The Senate of University College has accepted the offer of the Ramsay Memorial Committee of a sum of not less than £25,000 towards the foundation of a laboratory of chemical engineering at the college.

Work of the Medical Research Committee.—In an appendix to a memorandum recently issued by the Local Government Board on the work of the Medical Research Committee (Cmd. 69, 1*d*.), Sir W. M. Fletcher, secretary to that Committee, draws attention to a particular aspect of the value of a centralised State Department for research in medicine or other branches of science. Such a centralised department is eminently suited for garnering the by-products of specialised research throughout the country, and of bringing to the knowledge of Government Departments the work of a single Department which might otherwise escape notice. After referring to the fact that research in one direction may bear valuable fruit in another, and instancing the classic examples of the work of Pasteur and Röntgen, Sir W. Fletcher gives the following illustrations from recent history.

The need for administering oxygen effectively to soldiers suffering from gas poisoning has led to improved methods in the use of oxygen-enriched air in the treatment of disease, and of the application of oxygen mixed with laughing gas as an anæsthetic in dangerous cases of shock, as well as to the supplying of oxygen to aviators; mine rescue apparatus, in which oxygen is employed, will probably also be improved. Experiments on chlorine compounds as antiseptics led to the "Dakin" solution, then to Chloramine-T, and later to Dichloramine-T. A side inquiry resulted in the production of "Halazone," which has a high disinfecting power and is useful for sterilising water; and the close study of Chloramine-T has led to the discovery of its action on protein substances and thus given a means of effecting new transformations in organic compounds of biological importance. The successful investigation of toxic jaundice, caused by tetrachlorethane, used as an aeroplane dope, and by TNT, has instigated an inquiry into salvarsan-poisoning, a subject which at the present time is of importance to six Government Departments. From the investigation of the impurities of TNT there has resulted the discovery of a modified form of this substance which can be utilised in the chemical investigation of the protein molecule. The chemical structure of a substance called Carnosin, previously recognised as occurring in the human body, has been discovered, and the product artificially synthesised for the first time.

British State Mines in Nigeria.—The British Government is now an owner of coal mines and a distributor of coal in Nigeria. The mines are at Udi, 50 miles from Port Harcourt on the coast, with which they are connected by a Government railway. In 1917 these mines produced 85,000 tons, and in 1918 110,000 tons, valued at £28,000. The use of the coal has so far practically been confined to Government services, but it is hoped that

the private tin-mining companies will be able to obtain supplies in future. The heating quality of the coal is about 75 per cent. of that of the best Welsh coal.—(*Manch. Guard., Mar.* 31, 1919.)

Oil Fuel Reservoir at Rosyth.—The construction of a large reservoir at Rosyth for the storage of oil fuel has been completed recently by the Admiralty. The reservoir has been built of concrete on a rock foundation, and is the first instance of a large reservoir being constructed from this material. The concrete deposited amounted to about 98,500 cubic yards.—(*Iron and Coal Tr. Rev., Mar.* 28, 1919.)

New Edition of Beilstein.—The forthcoming publication of a new edition—the fourth—of Beilstein's "Handbuch der Organischen Chemie" is announced from Berlin. The first volume will be issued in 64 parts and will cost 66 marks. The completed work will comprise 15 volumes. The compilers are B. Prager and P. Jacobson, assisted by P. Schmidt and Dora Stern.

Associations of Academic and Technical Workers in Germany.—An "Imperial Committee of Academic Professions" has been formed in Berlin to promote co-operation between all who possess academic qualifications, and to safeguard their common interests. The association includes 70 federated societies and 220,000 members. A second association, called the "Union of Technologists," has among its aims, to secure an active participation of its members in public life, decision in technical questions solely by technical workers, better conditions of living for its members, and enlightenment of the people concerning the significance of technical work and the importance of maintaining it. Both associations include in their membership corporative bodies as well as individuals. The Verein Deutscher Chemiker is represented in both, and has issued an appeal to its members to accord their support.—(*Z. angew. Chem., Jan.* 7, 1919.)

The Position at the Hochst Dyeworks.—According to an official communication from the directorate of the Höchst dyeworks to the *Zeitschrift für Angewandte Chemie*, these works are not in French occupation but under the supervision of two French chemists, and work is proceeding without interruption. All the products, both those in stock and those newly manufactured, are in the first instance earmarked for the use of the Allies, but the remainder may, with the special sanction of the supervisors, be sent to the occupied parts of Germany. Under the same condition, pharmaceutical products may also be exported thither, and for this permission is being freely granted. Otherwise no restrictions are imposed, not even in the case of salvarsan. In the view of the management, there are considerable supplies of salvarsan available in Germany, and there can be no question of a serious shortage (*cf.*, this J., 1919, 108 R).—(*Z. angew. Chem., Feb.* 21, 1919.)

The Mansfeld Copper Mines.—At a recent meeting of the directors and officials of the Mansfeld copper mines, the chairman took a pessimistic view of the outlook. The expenditure between October 1, 1918, and January 20, 1919, amounted to about 47 million mk. against sales of only 20 million mk. Sales had declined from 11 million mk. in October to 2¼ million in December, and while American copper, it is stated, could be delivered at 350 mk. per 100 kilo., the prime cost of Mansfeld copper was about 700 mk. Those leaders of the miners who are conversant with the facts will admit that the socialisation of companies already working at a loss would only accelerate their ruin. The directors were, however, ready to examine any scheme for ameliorating the situation, since they intended to maintain in employment 180,000 men directly dependent on mining for their living. The only remedy for the present dangerous situation was the goodwill of the Entente, and the harmonious co-operation of the workers.—(*Frankfurt Z., Feb.* 5, 1919.)

Anhalt Potash Works.—The Anhalt Potash Works in Leopoldshall are owned and conducted by the Anhalt Government. Up to the outbreak of war the annual surplus profit amounted to about 1 million marks, but lately, owing to limited market possibilities, increased wages and largely increased expenses, there has been a monthly loss of about 200,000 mk. and this is steadily increasing.—(*Köln. Z., Feb.* 25, 1919.)

Selenium and Tellurium.—The elements selenium and tellurium are by-products of the copper industry, and could be produced in much larger quantities if there were a sufficient demand for them. The processes of production are simple, so that the cost could be reduced materially if the output were larger. Tellurium is used in certain alloys, and, in small quantities, as a colouring material for glass and porcelain, and selenium is valuable on account of its photo-electrical properties. The chief use of selenium is in the glass industry, but small quantities are employed in photographic chemistry, and in medicine. Wassermann has taken out a patent for the application of organic selenium salts. Selenium has been applied successfully to the "vulcanising" of rubber goods in place of sulphur. Vulcanised by that means, the goods are said to be more durable. The total production of selenium was about 10,000 lb. in 1913 and 30,000 lb. in 1914. Since then war conditions greatly restricted production.—(*Metall und Erz, Dec.* 22, 1918.)

Mineral Salt Deposits in Sicily.—H.M. Consul at Palermo reports that two natural deposits of sodium sulphate are being worked at Mangiabue and Sambuco, in the Province of Caltanissetta. The extension of the Mangiabue mine is estimated to contain 1½ million cu. m. of material containing 30—70 per cent. of sulphate. A plant has been erected for purifying the product, but it has not yet been operated. The Sambuco deposit contains mixed salts of magnesium and sodium with a variable percentage of potassium, analysis of one sample showing 12 per cent. K_2O, but others considerably less. The mineral is pure, situated close to the surface, and easy to work. Some of it is already on sale.—(*Bd. of Trade J., Mar.* 20, 1919.)

Castor Oil Production in Spain.—A new company is being formed to plant the "ricino" (*Palma Christi*) and to produce castor oil therefrom. Experiments have shown that the plant grows well in Andalusia and that two or three crops can be obtained in one year. The leaves and shoots produce good fibre for papermaking, the pith is suitable for stuffing lifebuoys, and the "Palma Christi" oil, expressed from the seeds, now fetches 8*s*. per kilo., as against 1*s*. before the war.—(*Bd. of Trade J., Mar.* 20, 1919.)

Magnesium in the U.S.A.—The production of magnesium on a commercial scale started in 1915 as a result of supplies from Germany being cut off, and to meet the greatly increased demand for the metal for war materials. In 1915 the output of the three producing firms was 40 tons of magnesium with an average selling price of 20*s*. per lb.; in 1917 five firms produced 51 tons of the metal with an average selling price of only 8*s*. 4*d*. per lb., but two of these ceased to manufacture on account of the low price. The pre-war price of the imported metal was 6*s*. 10*d*. per lb. Most of the magnesium produced in the United States is made from magnesium chloride residue (bittern) from the salt brines at Midland, Mich., from magnesite and dolomite from California and from Grenville, Quebec. A probable future source is San Fran-

cisco Bay, Cal., but almost inexhaustible supplies of suitable magnesium compounds are available. Magnesium is cast into rods 14—18 in. long and ⅞—2 in. diameter and is drawn into wire. The powdered material must pass through No. 200 screen in order that it may burn rapidly. The chief uses at present are (*a*) flashlights, (*b*) chemical reagents, (*c*) the ignition of thermite charges, (*d*) as a deoxidising agent, (*e*) as a constituent of alloys particularly in association with 8 per cent. of aluminium, which produces a metal of sp. gr. 1·75 with a strength equal to that of gun metal. Another aluminium-magnesium alloy containing only 2 per cent. of magnesium (magnolium) is used for making forks, spoons, etc., and, generally, where a light, white metal is required, (*f*) as a dehydrating agent, (*g*) for cathodes in the electrolysis of neutral or alkaline solutions free from heavy metals, and in the electrolysis of alkali chlorides. Magnesium anodes are used for producing galvanoplastic deposits of nickel and cobalt. It is considered probable that magnesium will shortly be used as extensively as aluminium.—(*U.S. Geol. Surv., Dec.*, 1918.)

Resources of China.—A very high quality of alum is produced in China and used for clarifying water, as a mordant in dyeing, and in sizing and whitening paper. About 13,000 short tons were exported in 1916, mainly to Japan for use in dyeing.

Asbestos is mined in Manchuria by a Japanese company. It is also found in North-Western Kwantung and in Hupeh province. The product is of short fibre.

Borax is found in Kansu, Anhui and Tibet, most of it coming from the Tibetan Lakes. It is used by the Chinese for glazing crockery, and as a flux.

Arsenical pyrites and orpiment occur in the north-western part of Yunnan. The exports of the latter from Yunnan and Hunan in 1917 amounted to 600,000 lb.

China at present supplies the greater part of the world's demand for antimony, 62 per cent. of the American imports of the metal in 1916 coming from that country. Most of the ore is mined in the Hunan province, where it occurs practically free from arsenic and contains from 20 to 64 per cent. of antimony. Smelting is done at Changsha, Hankow and Wuchang. Antimony is usually marketed in China in the crude form, containing 65 to 70 per cent. metal. The regulus assays at 98 to 99·8 per cent. The total exports in 1917 amounted to 15,000 long tons of regulus, 20,000 tons of crude, and 4000 tons of ore.—(*U.S. Com. Rep., Nov.* 27, 1918.)

Indigo and other Chinese Dyes.—Just before the outbreak of war, Germany was exporting to China indigo to the value of £2,000,000 and other dyestuffs valued at £600,000 to £800,000. To a great extent these had replaced the old Chinese vegetable dyes; in fact, indigo was no longer considered an agricultural product. With the war came a revival of the Chinese natural dyestuff industry and Chinese dyes are now beginning to figure in the export trade. Thus 5000 tons of liquid indigo and 2000 tons of other dyestuffs were exported in 1917.

Chinese indigo is a very weak product, containing about one per cent. indigotin. An acre yields about 60 lb. of pure dye. Other Chinese dyestuffs include a black obtained from gall-nuts and also from the capsules of acorns. The flower buds of the locust-tree (*Sophora japonica*) give a yellow on an alum mordant, whilst turmeric is also used for yellow shades. Safflower is used for red, and greens are produced from the bark of the *Rhamnus parvifolius* and the leaves of the *Rhamnus tinctorius*. Browns are produced from the false gambier. The vegetable dyes of China are particularly suited for rug dyeing.—(*U.S. Com. Rep. Supp., Feb.* 8, 1919.)

Memorandum on Patent Law Amendment.—The committee appointed by the Conference of Technical Institutions and Societies to formulate recommendations concerning the amendment of the Patent Law has duly reported, and the Institution of Electrical Engineers has prepared and published a memorandum based upon its findings. In the following summary of recommendations the Act referred to is that of 1907, and the Bill that of 1917, which was introduced into Parliament and later withdrawn.

Patents Moratorium.—It is recommended that an extension for a period equal to the total duration of the war should, on application, be granted in the case of those patents which were in force when the war broke out and are still in force when peace comes, and that in the case of patents which have expired by lapse of time during the war, the extension should be for a period equal to that from the commencement of the war to the end of the ordinary life of such patents, and that for patents other than war patents which have been taken out since war commenced, the extension should be for a period equal to that between the date of application and the end of the war.

It is recommended that provision should be made for opposition by any person alleging that he is prejudicially affected by the extension, but the onus of proof of injury of the same kind as is provided for in the case of restoration of lapsed patents should be on the opponent.

Compulsory Licences (Section 24 of Act).—That (*a*) petitions be made and heard by the Comptroller of Patents with final appeal to Court; (*b*) present power to order revocation under this section of the Act be cancelled.

Working of Patented Inventions (Section 27 of Act).—That this clause of the Act be deleted in its entirety.

Articles of Food, or for Medical Purposes, etc.—That the position under the present Acts should not be disturbed.

Clauses 5, 8, 9 and 15 of 1917 Bill.—That these clauses are approved, and should be adopted.

Term of Patents.—That the term of patents be extended to seventeen years.

Extension of Provisional Specification term.—That the term of provisional protection be restored to nine months, with right to extension for three further months on payment of a nominal fee.

Extension of term for Acceptance of Complete Specification.—That the term for acceptance of a Complete Specification be extended to eighteen months, with power on payment of fees to further extend to twenty-one months.

Patent to Bind Crown.—That all awards, royalties or payments to inventors for use of inventions by or on behalf of the Government should be decided by the High Court after hearing all parties, and that patentees should be entitled to apply to the Court for this purpose.

Cancellation of Registration of Designs.—That Clause 14 of the Bill of 1917 should be adopted, but restrictions of Section 56 of present Act should be removed.

Patents of Addition.—That provision should be made for maintenance of "Patents of Addition" through remaining available term of main patent, not only in event of revocation of main patent as proposed in the Bill of 1917, but at option of patentee on surrendering or lapsing of main patent.

Patent Fees.—That renewal fees should be reduced by one half.

Proposed New Tribunal.—That a special Division of the High Court of Justice be constituted to deal with patent and other litigation involving scientific and technical questions.

The reasons for the above recommendations are set out in the memorandum.

PERSONALIA.

With great regret we record the death of Sir William Crookes, President of this Society in 1913, in London on April 4 last.

Sir Auckland Geddes has resigned his office of Minister of National Service and Reconstruction, and has accepted the position of Principal of McGill University, Montreal.

Dr. A. Rée has been appointed Inspector of Research under the Government scheme for assisting the dye industry.

Sir Evan Jones is now officiating as Controller of Coal Mines, in addition to fulfilling his duties as Dyes Commissioner.

The death is reported of Sir E. C. Stirling, professor of physiology in the University of Adelaide, on March 20 last.

The Chair of Pathological Chemistry in the London University has been vacated by the resignation, owing to ill-health, of Prof. Vaughan Harley.

Major H. McCombie, lecturer in chemistry in the University of Birmingham, has been elected a Fellow of King's College, Cambridge.

The death is announced of Mr. Andrew King, assistant professor of chemistry in the Heriot-Watt College, Edinburgh.

The Council of the University of Leeds has appointed Mr. D. McCandish to the professorship of applied chemistry (chemistry of leather manufacture) at Leeds University.

The offer of the Mason Chair of Chemistry at the University of Birmingham, vacant by the resignation of Prof. Percy Frankland, has been accepted by Prof. G. T. Morgan, professor of applied chemistry at the City and Guilds Technical College, Finsbury, London. Prof. Morgan was formerly professor of applied chemistry in the Royal College of Science for Ireland, and prior to that editor of the Journal of the Chemical Society.

Mr. A. J. Turner has accepted the appointment of professor of textile technology in the College of Technology, Manchester. Prof. Turner has been in charge of the Fabrics Laboratory of the Royal Aircraft Establishment, conducting investigations on textile fabrics mainly from the physico-chemical standpoint.

The Cavendish Chair of Physics at Cambridge University, vacant owing to the resignation of Sir J. J. Thomson, has been filled by the appointment of Sir E. Rutherford, now Langworthy Professor of Physics at the University of Manchester.

Sir J. J. Dobbie, Government Chemist and President of the Chemical Society, has been appointed to serve on a Royal Commission to determine what awards and royalties shall be paid to inventors in respect of the use of their inventions by Government Departments during the war.

Capt. J. R. Partington has been appointed to the Chair of Chemistry at East London College. Prof. Partington is a graduate and former Beyer research fellow of the University of Manchester, and after serving in the army, has recently been in charge of research work in the Inventions Department of the Ministry of Munitions.

Lieut.-Col. W. Watson, who died on March 3 mainly from the effects of inhaling poisonous gases, was professor of physics at the Imperial College of Science and Technology at the time when he was sent out to France as director of the Central Laboratory, B.E.F., in June 1915. During the exacting routine of his work he was frequently "gassed," and his death is undoubtedly to be ascribed mainly to this cause. Prof. Watson was the author of many valuable investigations in magnetism and optics; his experimental work was characterised by great accuracy, whilst as a teacher he excelled in clearness of exposition. His "Text-Book on Physics" is well-known to all students of that subject. In recent years he took up the study of the petrol motor and his researches proved of great practical utility in connexion with aero-engines during the war. He was elected a Fellow of the Royal Society in 1901 and was created C.M.G. in 1916. His loss to science will be keenly felt.

COMPANY NEWS.

BORAX CONSOLIDATED, LTD.

Addressing the 21st ordinary general meeting on March 20, the Rt. Hon. the Earl of Chichester, chairman, said that the Company's mines in Turkey were intact and would be handed back by the Turkish Government; thus the German plans to sequestrate them had proved abortive. The stocks at mines, factories, etc. were valued at £588,197, and the volume of business, including that of the export trade, during the last financial year had declined. In the current year, business has been everywhere on a reduced scale, and buyers are waiting for the exhaustion of accumulated stocks. It is anticipated, however, that an improvement will set in after peace has been signed, particularly as the countries with which the Company formerly did business are denuded of stocks, both of raw and refined products. The profits of the year to September 30 last amounted to £431,342, compared with £385,527 in the previous year (issued capital £2,300,000; debentures £1,979,534). The balance at disposal is £396,196, out of which sum £60,000 is to be placed to reserves etc., a dividend of 2*s*. per share paid on the ordinary shares, making 15 per cent. for the year, and £105,371 is carried forward.

ANGLO-PERSIAN OIL CO., LTD.

At the 9th ordinary general meeting, held on March 26, Mr. C. Greenway, chairman and managing director, stated that during the past year the capital resources of the Company had been increased by £5,200,000, of which £1,750,000 was paid-up capital. H.M. Government had completed the purchase of the ordinary shares held by it. After making ample allowances for depreciation, the trading profit came to £1,516,994. The available balance for distribution is £779,709, and it was proposed to pay 8 per cent. on the ordinary shares, and to carry forward £454,722. The return to H.M. Government on its investment, including excess profits duty, is about 30 per cent. per annum. Within a very few years the through-put will probably be 5—6 times that of the year under review. The supply of oil is practically unlimited, the wells already drilled still maintain their extraordinarily high rate of yield, and are estimated to be capable of producing 5,000,000 tons per annum. The extensions to the refinery at Abadan should be completed during the year, and a large refinery is being erected at Swansea, the initial capacity of which will be twice that of the whole of the Scottish shale oil companies. The political situation in Persia has greatly improved. A profit-sharing scheme has been adopted for the benefit of the Company's employees.

LEVER BROS., LTD.

The speech of Lord Leverhulme, at the 25th annual general meeting, held on March 28, was of unusual interest owing to the description he gave

of the scheme it is proposed to establish for introducing a 6-hour working day or a 36-hour week in the Company's factories. Day-workers and piece-workers are to work in two 6-hour shifts, the morning shift being from 7 A.M.—1.15 P.M. with a 15-minutes' interval for a quick lunch provided on the premises at the Company's expense. The afternoon work is to be divided into four shifts of 7¼ hours and one of 7 hours per week, with a 30-minutes' interval for refreshments. Saturday afternoons and Sundays will be free. On the night shift, the employee will do 8 hours' work for one week out of four and 5 hours and 20 minutes for the remaining 3 weeks. The shifts will be changed weekly. The rate of wages will be the same as for a 48-hour week, and it is anticipated that production costs will not be increased, the staff recognising that any such increase would handicap the firm both in home and foreign competition. The scheme has yet to receive the sanction of the Home Office.

Lever Bros., Ltd., has now a capital of £60,000,000, with over 56,000 shareholders and about 100 associated companies. Co-partnership certificates to the value of £928,000 have been issued to employees, upon which £206,000 was paid in dividends during the past year. The rents of the thousand cottages and shops built on the estate have not been raised during the war, and there was a loss of £4000 under this heading last year. Notwithstanding the effects of Government control of trade and shortage of raw materials, the home and export trade increased enormously during the past year, the increases having taken place in countries like Japan, where no control has been in force.

After meeting all charges and paying off nearly £200,000 of debentures, and placing £1,679,000 to reserves, a dividend of 17½ per cent. is being paid on the preferred ordinary shares. In reply to criticisms as to the inadequateness of the reserves, Lord Leverhulme pointed out that the expenditure on repairs, renewals, depreciation and advertising amounted to £1,250,000, all of which was deducted from profits. The total amount spent on the above items up to date exceeds the issued capital of the Company—£17,000,000.

BRITISH ALUMINIUM CO., LTD.

At the annual general meeting, held on March 28, Mr. A. W. Tait, chairman, said that the output of aluminium during the last financial year was the largest in the Company's history, but owing to a reduction in price and to increased production costs, the trading profit showed a slight decline over that of the previous year, *viz.* £351,697, as against £368,509; on the other hand, dividends on investments were £16,500 higher at £68,577. The sudden cessation of hostilities in November last caused serious dislocation to the industry, involving immediate cancellation of large orders and accumulation of material. At the present time the Government is holding large stocks of aluminium, which it intends to dispose of gradually as the demand for the metal increases. This policy will entail, for a time, a diminished production in this country, but the more remote future of the industry is undoubtedly a bright one. The financial position of the Company is strong. The net value of the investments is £431,207, and the reserve fund stands at £470,599, compared with £220,599 a year ago, and nearly the whole of it is invested in Government securities. Debenture stocks have been reduced and now stand at £631,489. The profits are £420,426, the available balance £109,416, and the dividend on the ordinary shares is maintained at 10 per cent. per annum.

PARLIAMENTARY NEWS.

HOUSE OF COMMONS.

Export of Superphosphates and Compound Manures.

The Parliamentary Secretary to the Ministry of Munitions circulated the following reply to a question put by Lt.-Col. Sir F. Hall:—Arrangements have been made with the President of the Board of Agriculture for the release of certain quantities of superphosphates and compound manures for export under licence. Manufacturers to whom licences are issued have to pay to the Ministry of Munitions £4 a ton on compound fertilisers and £3 17*s.* 6*d.* on superphosphates, these sums being equivalent to the total loss incurred by H.M. Government in respect of raw materials used in the manufacture and packing of the exported goods. These figures represent maximum rates, and manufacturers have been informed that the average amount recovered by the Government would be £3 7*s.* 4*d.* for compound fertilisers and £3 0*s.* 4*d.* for superphosphates, a deduction of 18*s.* 4*d.* from these amounts being made in each case where the bags are provided by the manufacturers. The loss arises from the issue by the Government to manufacturers of pyrites, phosphate rock and bags at prices below cost, and the figures above quoted were calculated from data in the possession of the Explosives Supply Branch of the Ministry. The exact amount repayable will vary with the nature of the material exported. The trade has always been aware that the Government incurred a loss on the import of raw materials for fertilisers and that accordingly an appropriate proportion of this loss would be recoverable in case of export. I cannot agree with the statement that the condition in question imposes any handicap upon British manufacturers of compound manures and superphosphates, and no complaints to this effect have been received by the Ministry. The principle of recovering loss on the export of subsidised materials has been followed in the case of numerous commodities, and I therefore see no reason to reconsider the position.—(Mar. 24.)

Margarine Manufacture.

Answering Col. W. Thorne, Mr. Roberts said that on March 31 the prices per ton of the following raw materials would be:—Refined coconut oil, £64 10*s.*; refined American cotton seed oil, £64; refined, deodorised ground nut oil, £65; and refined, deodorised palm kernel oil, £33. These prices will entail a loss to the Ministry of Food. The present low retail price (8*d.* per lb.) is due to trade competition. The Ministry proposes to continue the arrangement by which manufacturers are licensed and weekly samples submitted.—(Mar. 25.)

Clinical Thermometers.

In reply to a question asked by Mr. Swan, Mr. Kellaway stated that in order to develop the supply of these instruments, which is now approximately twice as great as before the issue of the Order, arrangements have been made for the manufacture of the necessary kind of glass, and the makers are given expert advice in the production of the finished article. An average of 10 per cent. of the thermometers tested at the National Physical Laboratory has been rejected.—(Mar. 26.)

Glass Bottles.

Sir A. S. Benn was informed by Mr. Bridgeman that considerable efforts are being made by British factories to develop the production of glass containers, but the output is at present insufficient to meet requirements. Licences are, therefore, being granted to import glass containers when

there is evidence that adequate supplies of British-made goods are not available; and in the consideration of applications for licences particular attention is given to the requirements of the export trades.—(Mar. 31.)

Ministry of Ways and Communications Bill.

During the debate in Standing Committee, the Home Secretary accepted on behalf of the Government an amendment to exclude the supply of electricity from the scope of this Bill. The Government intends to deal with the whole question of electricity supply in a special Bill.—(April 8.)

GOVERNMENT ORDERS AND NOTICES.

PROHIBITED EXPORTS.

Further relaxations of existing export prohibitions are notified, as follows:—

Headings transferred from one list to another.

From List A to List B:—

Malt sugar, and articles and preparations containing; potassium bicarbonate and mixtures containing.—(Mar. 27.)

From List A to List C:—

Wood pulp.—(Mar. 27.)
Goatskins; kapok; wire rods.—(April 3.)

Altered Headings.

(A) Sheepskins, haired or woolled. (C) Sheepskin pelts, dehaired or dewoolled. (A) Cod liver oil and preparations containing. (A) Malt extract and preparations containing.—(Mar. 27.)

(A) Copper and alloys of copper. (C) Bars, circles, plates, rods, sheets, strip, tubes, etc. of copper or copper alloy. The following compounds of potassium are deleted as separate headings in List B because they are already covered by the heading: (B) Potash salts and mixtures containing such potash-salts not otherwise prohibited:—Potassium bicarbonate, cyanide, perchlorate, prussiates, chlorate, and mixtures containing.—(April 3.)

Exports to Occupied Areas.—The Board of Trade has issued regulations (Mar. 30) and modifications thereof (April 3) concerning the conditions under which goods may be exported to the occupied areas on the left bank of the Rhine. The "free" goods (v. *Bd. of Trade J.* of March 20) may still be exported without licence or permit, but a definite procedure must be followed in the case of certain specified goods. The latter include many metals, absolute alcohol, fats for industrial purposes, textiles, silk, wool, arc carbons, graphite, white and red phosphorus, phosphoric acid, hides and skins, resins and rubber, various tanning materials, and substances used for the manufacture of explosives and asphyxiating gases.

PROHIBITED IMPORTS.

A complete list of articles the importation of which into the United Kingdom has been prohibited, except under licence, by Royal Proclamations of February 15, 1916, and subsequent dates, was given in the *Board of Trade Journal* of March 27 last.

A general licence has been issued for the importation of red oxide of iron.

Trade with Poland and Esthonia.—In agreement with the other Associated Governments, H.M. Government has decided that commercial relations with Poland shall be free as from April 1, and the Board of Trade has issued a general licence to give effect to this decision. Trade with Esthonia may also now be resumed.

Acids and fertilisers.—The Minister of Munitions announces that control of acids and fertilisers by his department will be suspended on and after June 1, 1919. This will apply to sulphuric acid, sulphate of ammonia, superphosphate, basic slag, compound fertilisers. All questions relating to the distribution of fertiliser materials will, on the release of formal control, be dealt with by the Department of Agriculture. The continuance on a voluntary basis of the distribution of fertilisers at fixed delivered prices is now under discussion with the trades concerned, and communications should be addressed to the Commercial Secretary, Board of Agriculture and Fisheries, 72, Victoria Street, S.W. 1.

Import of Dyestuffs.—The Trade and Licensing Committee appointed by the Board of Trade to administer the Prohibition of Import (No. 29) Proclamation relating to the import of dyestuffs gives notice that as from and after April 14, the general licence given on February 27 last in respect of the import of products covered by the Proclamation but which are of *bona-fide* American, French and Swiss origin will be revoked. All consignments, however, which can be shown to the satisfaction of the Customs Authorities as having been en route from the place of origin in any of the countries mentioned above to the United Kingdom on a through bill of lading on April 9, 1919, will be admitted without special licence, but in all other cases a permit must be obtained from the Trade and Licensing Sub-Committee prior to the purchase abroad of dyestuffs or other products covered by the Proclamation. Applications for permits should be made on the prescribed form to be obtained from the Secretary, Trade and Licensing Sub-Committee, Board of Trade, Danlee Buildings, Spring Gardens, Manchester.

NEW ORDERS.

The Silver Bullion (Maximum Price) Order. H.M. Treasury, Mar. 25.

The Steel Supplies (Partial Suspension) Order, 1919. Ministry of Munitions, April 1.

The Coal Tar and Coke Oven Returns (Suspension) Order, 1919. Ministry of Munitions, April 4.

NOTICES.

The Army Council has given notice to cancel the following Permits and Orders:—

The Imported Goatskin and Sheepskin Leather Permit, 1919 (Mar. 21); the Imported Leather (British Empire), Permit, 1919 (Mar. 21); the Rough and Curried Leather Order, 1917, the Strap Butt (Conditions of Sale) Order, 1917 (April 1); and the Hides (Splitting) Order, 1917 (April 2).

The Lords Commissioners of H.M. Treasury have given notice that they have issued a general licence for issues of capital by companies resident or carrying on business in the U.K., for capital purposes within the U.K.

The Board of Trade gave notice on March 29 that the following Orders cease to have effect as from March 31:—The Matches Order, 1917, the Matches Order (No. 2), 1917, and the Wholesale Dealers' Prices for Matches, 1918.

The Food Controller has suspended, as from April 1, the maximum prices fixed for cattle cakes and meals, excepting all classes of cotton and linseed cakes and meals.

The Ministry of Munitions has given notice that on April 30 next all subsidies in connexion with the manufacture of iron and steel, including those on iron ore, coke and pig iron, will be withdrawn.

OFFICIAL TRADE INTELLIGENCE.

(From the Board of Trade Journal for March 27 and April 3.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 73, Basinghall Street, London, E.C. 2, from firms, agents or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

Locality of Firm or Agent	Materials	Reference Numbers
Canada	Drugs	487
,, ...	Artists colours	542
,, ...	China	552
,, ...	Soya bean oil & peanut oil	553
,, ...	Oils, greases and soap ..	554
,, ...	Sheet lead rolls for rolling chemically pure lead, and lead containing 2 to 7% antimony, in sheets 8 to 9 feet wide	*
,, ...	Chemicals and drugs ..	*
India	Paint	475
,, (Rangoon)	Dyes	476
,, ,,	Machines for crushing oil seeds and plant for pulverising and briquetting lignite	477
South Africa ..	Paper	494
,, ..	China and glass ..	561
Egypt	Soda crystals, soap, paints, sheet metals, oils, glass and earthenware	563
Belgium ..	Antifouling paints and varnishes	502
,, ..	Chemicals, drugs, colours and varnish	507
,, ..	Oils, starch and fertilisers	573
France	Iron, steel, copper, etc...	515
,, ...	Machines for making condensed milk and milk powder	516
,, ...	Soap	580
,, ...	Cocoa and chocolate ..	579, 581
,, (Morocco)	Chemicals	582
Italy	Oil seeds, vegetable oils and oil cake	584
,, ...	Medicines, essences and soap	522
,, ...	Dyes and leather ..	1640†
,, ...	Nitrates, oil seeds, metals and tinplate	1642†
,, ...	Chemicals, copper sulphate, caustic soda, soda ash, oils, fats, paints and varnishes ..	1644†
,, ...	Photographic films and paper	1654†
,, ...	Chemicals	1657†
Trieste	Oils, fats, copra and fertilisers	566
Netherlands ..	Earthenware wall and floor tiles	525
Spain	Drugs	593
Switzerland ..	Chemicals	596
New York ..	Chemicals	534
Brazil	Chemicals	575
South America and British West Indies	Paints, varnish, starch and baking powder ..	590
Palestine ..	Metals, tinplate, rubber, asbestos, mineral oils, caustic soda, soda H, drugs and vegetable fats	529
Java	Chemicals, dyes, soap and fertilisers	496

* High Commissioner for Canada, 19, Victoria Street, S.W. 1.
† The Secretary, British Chamber of Commerce for Italy, 7, Via Carlo Felice, Genoa.

A Canadian correspondent desires to get into touch with U.K. importers of magnesite. Inquiries should be addressed to The Canadian Government Trade Commissioner, 73, Basinghall Street, E.C. 2.

TARIFF. CUSTOMS. EXCISE.

Belgium.—The prohibition of the importation of spirits is still in force, but the question of liquor control is under consideration, and it is possible that the existing regulations may be modified in the near future. Import licences are no longer required for brewing malt.

British West Africa.—The importation of all spirits is prohibited for the present, except under licence.

Canada.—The regulations governing prohibited exports have been amended as from March 1.

France (Algeria).—The visa of the Office National des Papiers is no longer required with applications for French import licences for vulcanised fibre.

France (Madagascar).—A copy of an Arrête of the Governor-General which fixes the amount of the statistical tax on imported merchandise may be seen at the Department of Overseas Trade.

France (Tunis).—The list of articles the export of which is prohibited is the same as that annexed to the French decree of January 20, together with certain other articles, including pimento, charcoal and sulphur.

Among the articles the import of which is now permitted are vegetable, mineral and fish oils, camphor, rubber, chemical manures, celluloid, window glass and bottles.

Italy.—The export of marble and alabaster is now permitted.

Japan (Corea).—As from February 5, a permit from the Chief of Police is required for the export and re-export of morphine, its compounds and derivatives, opium and manufactures thereof, hydrochlorate of cocaine, quinine sulphate and hydrochlorate, antipyrin, pyramidon, thymol, santonin, guajacolum carbonatum, radix scopoliæ, radix filicis and sandal wood oil.

Mexico.—The customs duties on alcoholic liquors have been increased as from February 17, and the import duty on caustic soda and potash fixed at 5 cts. per kilo. Cotton seed is admitted free, and the export duty on raw cotton reduced from 3 to 2 cents (Mexican gold) per kilo.

The export duties on alcoholic beverages, metal scrap, iron and steel scrap, hoofs and horns, have been modified.

New Zealand.—The prohibition of the importation of explosives containing more than 50 per cent. of nitroglycerin is cancelled.

Paraguay.—The export duty on quebracho logs has been reduced, as from February 15, from 5 to 3 dollars (gold) per metric ton.

Straits Settlements.—The Food and Drugs Ordinance has been amended to prohibit the importation of specified articles which are either dangerous or unsuitable as articles of food or medicine. The nature of any poison contained in medicines must be disclosed.

United States.—Licences will be issued for the importation of ferromanganese contracted for prior to April 6, 1917.

Individual import licences are now required for shipments of sugar to the U.S.

The special export licence "R.A.C. 42" for goods conveyed in-transit through the U.S. has been revised as from March 1.

Basic Slag Industry.—A Basic Slag Association has recently been formed with the object of safeguarding and promoting the interests of manufacturers. The officers are:—Mr. A. W. Thomson (Alexander Cross and Sons, Ltd.), chairman; Mr. G. V. Parker (The South Wales Basic Slag Co., Ltd.), vice-chairman; and Mr. W. H. Barnett (Alfred Hickman, Ltd.), hon. treasurer. The Secretary is Mr. J. King Stewart, of 70, Fenchurch Street, London, E.C. 3.

REVIEWS.

MODERN CHEMISTRY AND CHEMICAL INDUSTRY OF STARCH AND CELLULUSE (*With Reference to India*). *By* TARINI CHARAN CHAUDHURI, M.A., *Professor of Chemistry, Krasnath College, Berhampore (Bengal). Pp.* v + 156. (*London and Calcutta: Butterworth and Co.,* 1918.) *Price Rs.* 3.12.

In regard to the inception of this little book, the author himself may be quoted. Thus he states: "While engaged in the study of starch and cellulose, the writer felt the necessity for a handy compendium on the subject containing up-to-date information on all its bearings." This is not a little ambitious for so small a work.

It is evident from the text (which is divided into two parts, theoretical and industrial) that the author has not made himself acquainted with the subjects with which it deals. It abounds with the wildest and in many cases most inaccurate statements, whilst the sequence is rambling, and irrelevant matters are all too frequently met with; moreover the diction may, without carping, be severely criticised. A few quotations from the text will suffice to justify these strictures.

Admitting that more starchy food is consumed in the East than in Europe, we are not prepared to accept the author's dictum that all people are fed and clothed by starch and cellulose, nor can we agree with him that glycogen is an example of "animal cellulose." We read that "starting with the elementary substances—black carbon and gaseous hydrogen—the substance . . . has been prepared . . . known . . . by the name of formaldehyde." The fact is mentioned that according to Aubert and Giraud cane sugar is obtained by passing an electric current through acidified starch paste at 100° C. We were not aware that this observation had been "certified by subsequent investigators."

The manufacture of artificial perfumes, of alcohol, of rubber, and of gas mantles is dealt with, as are also tannin, turpentine, rosin, "*essential oil*" (the italics are ours) and cinnamic acid. From a chart showing the technical applications of starch we reproduce the first lines.

Most staple of Animal-Foods. Size in paper manufacture, stiffening and glazing material in textile industry and laundry, &c.	Starch $(C_6H_{10}O_5)_n$	Barley powder, sago, arrowroot, vermicelli, toilet powder, &c. Extensive use in condensed milk manufacture.

In the succeeding portions of the chart the following *inter alia* are mentioned as products obtained from starch :—Chloroform, iodoform, antifebrin, sulphonal, artificial perfumes, synthetic rubber and xylodine or white gun powder.

A similarly extravagant chart is given for the technical applications of cellulose. Thus the uses mentioned for cellulose include "Animal food, wood flour, oxalic acid, incandescent gas mantles, barks and leaves of tree as writing material, textile industry, ropes and nets, indestructible textiles from pure cellulose, artificial silk." For the inclusion of "tortoise shell" and of "mother of pearls" in this cellulose chart, the author may not unreasonably be asked for further explanation.

These are but a few citations from the book before us, which we feel compelled to condemn in every respect as one which not only fails to fulfil its objects, but which is also calculated to mislead the unwary student.

ARTHUR R. LING.

PETROLEUM REFINING. *By Andrew Campbell, with a Foreword by Sir Boverton Redwood, Bart. Pp.* 282 *with* 138 *illustrations, including* 29 *folding plates and* 3 *diagrams, also* 11 *tables.* (*London: Chas. Griffen & Co., Ltd.* 1918.) *Price 25s. net.*

The economic future of the world as we know it to-day is bound up with the development of the petroleum industry. Although there is much scientific literature on this subject, there was room for a work on the refining of petroleum products, and Mr. Campbell has given us a book, written with the gift of lucid expression, which describes in detail an industry which constant association has made a part of his life. The chemist and engineer interested in the petroleum industry will find this work not only useful as a book of reference, but one which is worthy of reading; at the same time business men and others whose interests are associated with the petroleum industry will gain much knowledge from its perusal without being confounded by abstruse technicalities.

The book has been divided into nine chapters, which deal respectively with the examination of the crude oil, the organisation of a refinery, storage, distillation, paraffin extraction, candle manufacture, chemical treatments, the distribution of products and engineering specifications. This form of treatment enables one to follow the crude oil from the time it enters the works until it leaves the works as a finished product.

The chemical treatment of petroleum, dealt with in Chapter 7, is a subject with a great future before it. In a work of such excellence, one objects to criticisms, but when a new edition of the book is prepared, one would like to see this chapter extended so as to give a more vivid idea of the importance of chemical treatment in the economics of petroleum refining. The inclusion of the Edleaneau process in this chapter for the refining of petroleum products at low temperatures with liquid sulphur dioxide is of great importance, because this method is only in its infancy, and it may eventually prove that the extraction of certain substances from petroleum by this physical means may prove more economic than the chemical methods at present mostly used for this purpose.

The appendix should appeal to all chemists, who are desirous of consulting literature dealing with the practical side of the industry. It may not be complete, but the references given are sufficient in themselves to enable cross-references to be found, from which a more complete list can be compiled. In conclusion, the author is to be congratulated on his first literary effort, and chemists can only hope that other leaders in the various industries will discover the same gift and write books of reference on their own specific subjects following the present author's example by the inclusion of many woodcuts and drawings, for these enable the reader to follow the description given and obtain a clear comprehension of the class of plant and details of plant used.

M. BENNETT BLACKLER.

PUBLICATIONS RECEIVED.

A SYSTEM OF PHYSICAL CHEMISTRY. *By* W. C. McC. LEWIS. *Second Edition. In three volumes. Vol. III., Quantum Theory. Pp.* 209. (*London: Longmans, Green and Co.* 1919.) *Price 7s. 6d.*

THE PHYSICAL CHEMISTRY OF THE PROTEINS. *By* T. B. ROBERTSON. *Pp.* 483. (*London: Longmans, Green and Co.* 1918.) *Price 25s.*

EDUCATION SECONDARY AND UNIVERSITY. *A Report of Conferences between the Council for Humanistic Studies and the Conjoint Board of Scientific Societies. By* F. G. KENYON. *Pp.* 47. (*London: John Murray.* 1919.) *Price 1s.*

STATE-AIDED RESEARCH.

Sir Frank Heath's paper on the Government and the organisation of scientific research, read before the Society of Arts, gives a succinct account of the origin and aims of the Advisory Council of Scientific and Industrial Research, which are stated briefly to be:—(i) The encouragement of research workers, (ii) the organisation of research by industries, (iii) the organisation of national research.

The paper evoked an interesting discussion which is printed with it in the *Journal of the Society of Arts* for February 21.

The creation of the Advisory Council is essentially an experiment and as such invites criticism from the scientific men. It is hoped this will be forthcoming and taken into account by the Government in making alterations from year to year that will add to the efficiency of its scheme. The purpose of the Council is the spending of national money on research; the difficulty is to secure adequate Exchequer control over such expenditure without imposing conditions which will hamper the initiative and freedom which are essential for successful research.

The Council rightly puts in the forefront of its aims the encouragement of the worker in pure research by making grants "in liberal measure" to those who need assistance and "with no restrictions beyond the necessity of showing that they are continuing their work," the appointments being made mainly on the recommendation of teachers, heads of institutes and the like. This is most satisfactory, though there is a growing tendency at the present time to debase the word research and misapply it to much which is very little more than routine work carried out by imperfectly trained investigators. It is to be hoped that the Council will continue to endow adequately and to encourage the research worker so that he is not tempted from his proper sphere of work to more highly salaried positions of an administrative character.

The encouragement of research in the industries is to be effected in the main by the formation of research associations, at first sponsored by the Council on the principle of grants of a pound from the State for every pound subscribed by the industry, but which may be expected ultimately to continue without State assistance. The experience of these associations will be watched with interest. The proposal is best suited perhaps to some of the less scientific industries and smaller manufactures; it is of debatable applicability to those branches of chemical industry in which research must be a matter for each individual firm. Many chemists are of the opinion that it will be more satisfactory and more likely to lead to progress for every firm of sufficient size to employ its own staff to study its own problems rather than to rely on a State-controlled association. If State-aided research tends in any way to restrict or lessen private enterprise much harm rather than help is likely to result. Moreover, as industry as a whole will be taxed to support these research associations it behoves the professional societies to watch carefully lest the associations undertake work which is not really research, but which belongs more properly to the chemist, public analyst or consultant, or set out to duplicate and publish, at the cost of the State, information which has already been gained by firms which have realised the advantage of maintaining a research laboratory.

The Advisory Council is also willing, in special cases, to assist researches for the benefit of specific branches of industry, which are sponsored by recognised public bodies, such as the Society of Chemical Industry, and administered by committees of experts. We believe that its aid in such cases should be given far more freely than at present and on a more liberal basis than in the case of trade associations, seeing that the scientific societies seldom have funds available for such purposes; it is just in these cases that the restrictive conditions governing the grant are reputed to be most onerous, so that in more than one instance the work could not be undertaken.

With the exception of larger national problems, to which reference will be made later, few who have had any real experience of industrial research will do otherwise than urge that it is impossible and impracticable to divorce the research from the factory, and that no body of research workers however constituted can hope to achieve more than the preliminary, theoretical study of the process. The step from the laboratory to the factory is far greater than is generally admitted and any neglect of this essential factor will inevitably lead to failure and financial loss.

In the case of problems of wide national interest, such for example as fuel research, the policy of the Council is to set up separate research boards with salaried administrative officials. Such boards may administer special research stations, as that established by the Fuel Research Board, and will organise more or less comprehensive schemes for attacking their problems. This procedure is all to the good and highly creditable as an example of initiative by the State, provided always that nothing is done to restrict private enterprise in the same field, even for instance by refusing financial aid to apparently rival schemes. It is no doubt desirable to prevent overlapping in the case of committees, but duplication of work in the sense of investigations towards the same end on roughly parallel lines, to say nothing of an attack on the problem from other points of view, is the only real way to achieve success. Nature only gives up her secrets with difficulty: she must be wooed and cannot be driven even by legislator, administrator or research worker. Lastly, and this is all important, it should be urged that the leading directing positions in these research boards should be entrusted to men in the prime of life and at their period of greatest scientific activity, and that the tenure of office should be limited so as to ensure that a constant succession of new ideas and new ideals are applied to the problems involved.

The new Department will also act to carry out investigations for other Government departments and will no doubt seek to establish itself as scientific adviser to the administrative departments.

There can be no doubt that the establishment on a firm basis of the Advisory Council for Scientific and Industrial Research marks a great advance in the recognition by the British Government of the potentialities of science. The Council will have unique opportunities for doing good service both to science and to the State, and whilst it must expect criticism in detail from so exacting a public as the body scientific, this is only likely to be inspired by the warmest desire to assist in shaping its plans and in directing its activities to a successful issue.

Glass Research Association.—The Controller of the Glassware Department of the Ministry of Munitions has called a meeting of manufacturers to discuss the formation of a Glass Research Association. A provisional committee has been appointed. The Government is being asked to provide £75,000, extending over a period of five years, and the manufacturers will probably contribute £25,000. The Association will first consider problems concerning machinery and labour-saving devices.

RECENT ADVANCES IN MILLING AND CLARIFICATION IN CANE SUGAR MANUFACTURE.

J. P. OGILVIE.

Economic limit of extraction.—During the past few years, a considerable advance has been made in the extraction of sugar from the cane by milling. This has been accomplished by increasing the number of the 3-roller units in the train of mills; by installing devices, such as shredders and revolving knives; by grooving the rollers; and by the more efficient application of water and weak juice to the crushed cane (maceration), as well as by closer attention to mill settings and the rate of grinding. Owing to these improvements, it has become possible to extract 96—98 per cent. of the sucrose originally present in the cane, a figure which formerly was deemed attainable only by the diffusion process, now solely used in beet sugar factories.

Some manufacturers, however, are pointing out that there may be an economic limit of extraction, and that yields of 96—98 per cent. may approach if not exceed it. An increased extraction not only necessitates the modification of the milling installation, but it also generally involves an expansion of a portion of the plant, since there is then more juice to be heated and subsided; more "mud" or insoluble impurities separated in clarification to be treated in filter-presses; and also more water to be eliminated in the evaporators. It may further require extra fuel, for when a 9-roller is converted into a 12-roller mill there is a further demand for steam, which cannot be supplied by the quantity of bagasse available as fuel. In contemplating, therefore, the improvement of the milling installation, several questions arise. It is necessary to estimate how much additional sugar will actually find its way into the bags; and against the value of this further recovery one must balance items such as the increased capital expenditure, the increased operating expenses, the higher rate of depreciation, and lastly the value of any extra fuel that may be used.

This matter of the economic limit of extraction has recently been debated in a symposium by plantation managers and chemists in Hawaii,* which country has been foremost in devising improved methods of milling. In general, the opinion in the islands is in favour of high extractions; but it is realised that the root of the question is the extent to which the extra sucrose extracted as juice by the improved installation is actually recoverable in the form of commercial sugar. During milling, the last juices extracted by the maceration water contain appreciably more impurities than the first expressed, and these impurities have an inhibiting effect upon the crystallisation of sucrose from the concentrated syrup. It therefore follows that although an appreciable increase in the extraction by one or several of the devices mentioned may be effected, the extra sucrose may be accompanied by such a quantity of impurities that the further working of the juice may prove unprofitable. It is this condition that controls the economic limit of extraction.

Definite data are still rather insufficient; but in Hawaii it appears very generally to be thought that under the conditions prevailing there an extraction of 96—98 per cent. does not exceed the economic limit. It is estimated by W. Searby that by increasing the extraction to the extent under discussion, 75—80 per cent. of the additional sucrose passing into the juice can be recovered as commercial sugar; while figures collated by H. Johnson from the returns of a number of different factories indicate that with the gradual increase of the extraction there is a corresponding increase in the total recovery.

* Report on Milling, by H. Johnson, S. S. Peck, R. S. Norris, J. N. S. Williams, and W. Searby; *Intern. Sugar J.*, 1919, 21, 17—22.

In one of the mills in the territory in which certain improvements had been installed, the extraction showed an increase of 1·6 per cent. It was determined that this represented 4 lb. of 96° commercial sugar per ton of cane milled as the gain resulting; and, using this figure as a basis, a useful example of the method of calculation employed to establish the profit or loss under different conditions is given by J. N. S. Williams, the superintendent of the mill concerned. The additions had comprised a new boiler, a shredder, 3 new rollers, and 3 pairs of mill cheeks, the total expenditure upon which was $32,986. With 120,000 tons of cane for a crop, and with the price of sugar at 6 cents per lb. in New York, the 240 tons of extra sugar yielded nett proceeds to the plantation of $23,190. From this sum must be deducted the interest on the increased capital expenditure, the increased cost of bags, and the increased depreciation and repairs, a sum amounting to $17,614, which taken from $23,190 shows a gain of $5,576 for the crop. If, however, 100,000 tons of cane had been ground, the extra sugar would have been only 200 tons, and the gain would work at $1,926 at 6 cents; and at only $766 if the price fell to 5 cents. On the other hand, if 100,000 tons were ground, and the price was still 5 cents, there would result a loss on the undertaking of $3,074.

These data are suggestive, and show that full consideration must be given to all items entering into costs when contemplating improved milling installation. On studying the question of the economic limit of extraction, it becomes certain that the expenditure of large sums of money upon different new devices is justified only when the factory is milling a large crop of cane; when the price of sugar is high; and finally when the cane is of good average quality, that is, when it contains juice of high sucrose content and of high purity.

Abolition of filter-presses in clarification.—At the present time, in clarifying the raw juice coming from the mills in cane sugar factories, the almost general practice is to treat with lime until the acids present are neutralised (or almost so); to heat nearly to boiling point; and to allow the precipitate formed to settle out in suitable subsiding tanks. This is the so-called simple "defecation process." By the action of lime and heat in this way, the albuminoids of the juice are coagulated, while part of the acids combine to form insoluble calcium salts, the result after settling being the formation of a deposit consisting of the heavier solid constituents, and of a scum composed of the lighter impurities, which rises to the surface.

Hitherto, the usual procedure in dealing with this insoluble matter or "mud" obtained from the subsiding tanks after drawing off the clear juice has been to wash it in filter-presses until its sucrose content is sufficiently reduced, after which it may be utilised as fertiliser on the cane fields of the plantation.* In Australia, however, a process has been introduced into a number of the factories there, by means of which the use of filter-presses for the washing of clarification "mud" is entirely abolished. A considerable saving in labour installation, and filter-cloth, and the general simplification of the clarification process, are claimed to result from this new method of working.

* In passing, it may be noted that in Natal the filter-press cake is treated for the extraction of the wax it contains. This product is said to resemble carnauba and beeswax and to find a ready demand among boot and furniture polish manufacturers in the Union. About 250 tons is stated to have been shipped to this country from South Africa during the past two years.

Briefly, this procedure, which has been protected by N. M. Thomas and C. F. Petrec,* consists in returning the defecation mud to the train of mills, where crushing and maceration (spraying with water and weak juice) are proceeding. It is obvious that this must be done in a particular way. For example, the successful operation of the milling process would be checked by placing upon the cane undergoing extraction a mud containing more sucrose than is present in the juice with which the bagasse (crushed cane) is saturated. Such a step would mean, either that more sucrose would be lost in the final bagasse, or else that more water would have to be sprayed upon the bagasse in order to reduce its sucrose content to a reasonable figure, the increase of the cost of evaporation being thus entailed.

According, therefore, to the new procedure, the ordinary routine of clarification is modified somewhat so as to produce a mud having a low sucrose content. The richer juice expressed by the first mills is defecated separately, and the resulting mud is mixed with the weaker juice coming from the latter units of the milling train, which mixture is also defecated. It is the mud of reduced sucrose content thus produced from the weak juice that is distributed over the bagasse at a suitable stage of the crushing process. In a crushing installation having three 3-roller mills, this specially prepared mud would be applied to the bagasse leaving the first mill, at the same time macerating with weak juice from the third mill, while the bagasse after leaving the second mill would be macerated with water.

Possible objections to such a process that at first thought arise are that the purity of the juice might be lowered by the re-solution of certain of the constituents of the mud; and further that the burning properties of the bagasse when used as fuel under the boilers might be affected adversely. Experience in factories in Queensland would appear to prove that neither of these suspected defects arises in practice. Evidence is adduced by the management of eight factories (two of which are owned by the Government) that the juices obtained are as high in purity, and at least as clear, as those resulting from the method formerly in vogue; and that, moreover, there is no trouble with clinkering in the furnaces.

At present this new procedure is in use in about twenty factories in Queensland, Fiji, and it is being introduced into other sugar-producing countries.

THE IMPORTATION OF FOREIGN MANUFACTURED WOOD CHARCOAL.

The Association of British Chemical Manufacturers.

The fact that the manufacture of certain dyes, fine chemicals, etc., is entirely dependent upon the products of wood distillation, and that this country's production is at present inadequate, renders it essential that the expansion of the wood distillation industry should be encouraged. In the past the industry has been limited by the small home demand for charcoal and the competition of Continental charcoal imported at low prices.

The production of charcoal in tons per annum has been approximately as follows:—Pre-war period (1911-1913) B.W.D.A., 14,938; forest burnt, 5,600; total, 20,538. War period (1915-1917) B.W.D.A., 11,601; forest burnt, 5,600; total, 17,201. (B.W.D.A., British Wood Distillers' Association.)

In the pre-war period the imports of charcoal probably amounted to 6,000 tons per annum, but statistics are not available, as they are not separately stated in Board of Trade returns; neither are they so stated in the export returns of Germany, Austria, Scandinavia, France, or Holland.

During the war period the production of charcoal in Government factories has been considerable, but official figures are not available. During this period the demand was almost unlimited, but with the cessation of hostilities it fell away, and the present position is now as follows:—(1) Private wood distillers are continuing to produce charcoal; (2) Government factories are also producing charcoal; and (3) imported charcoal may very soon come into the home market.

The future of the wood distillation industry, and as a consequence that of the industries dependent upon it, rests entirely upon the policy to be adopted now.

(1) and (3) were co-existent in the pre-war period, and the result was a struggling industry which lacked entirely the prospect of reward necessary to stimulate research and aggressive organisation, and left the country dependent upon outside supplies for materials of vital importance at a time of national danger.

If (1) private wood distillation is to be encouraged (3) imports of charcoal will need to be restricted, or totally prohibited, unless they are required for Government purposes or are permitted by special Government licence.

(2) Government factories, although in existence to a certain extent prior to the war, are a new factor in the situation, and their disposal or administration arises naturally out of the question at issue. To prohibit importation of charcoal and to allow the product of the Government factories to enter into *unrestricted* competition with the private manufacturer would at the very least annul and stultify all benefit, but to allow (1) (2) and (3) to continue co-existent would first of all extinguish the private manufacturer, and then rob the Government factory of any contribution which the sale of charcoal would otherwise make towards cost of maintenance.

As to the anticipated production of charcoal in the post-war period, it will be worth while setting out the conditions which govern production, viz.:—(1) The supply and cost of raw material; (2) the supply of labour; (3) the demand and ruling prices for charcoal and wood tar (these being the products which have proved most difficult to sell and impossible to store). All these conditions are at present most uncertain, but, given sympathetic consideration by the Government Departments concerned, the production of charcoal will approximate very quickly to the pre-war standard, and in the near future will be increased substantially.

It is impossible to discuss the suggested prohibition of the importation of wood charcoal without reference to the disposal or administration of the Government factories concerned in its production. In spite of the consideration that on general grounds it is undesirable that Government-owned factories should manufacture chemical products except for use in other Government-owned factories, it is conceivable that the private wood distillation industry of this country will not be able to supply the full requirements of the various branches of chemical industry in the products of wood distillation other than charcoal, and the wood distillation industry might be willing to acquiesce in the continued working of the Government-owned factories to a degree, providing that suitable steps were taken to safeguard the interest of the private manufacturer.

It has already been proposed to the Ministry of Munitions that minimum sale prices should be fixed from time to time, such prices to be agreed by the Wood Distillers' Association or their representatives, and the Minister of Munitions or other

* U.S. P t., 1, 266, 882; J., 1918, 557 A.

Government Department, or a representative thereof, and that the prices shall be equally binding upon the private manufacturers and upon the Government factories.

If this proposal be accepted it will go far to solve the problem of Government competition, but it should not be overlooked that the legality of a Government Department competing with a private trader (in the absence of the Defence of the Realm Act) remains to be decided.

It is well known that the Council of the Association of British Chemical Manufacturers does not look with approval on the possibility of the continuation of Government-owned factories, but there is no doubt that, if the anticipation and hopes which have been encouraged during the war of an extensive growth in our dyes and fine chemical industries are to be realised, it will be necessary to continue operations at these new wood distillation factories erected by the Government in order to ensure adequate supplies of essential materials. The conditions under which the factories shall be continued in operation are a matter for further consideration.

To conclude (1) private wood distillers, (2) Government factories, (3) importation of foreign charcoal cannot co-exist, and the suggested solution is that importation of charcoal shall be prohibited in order that there may remain an adequate market for private wood distillers and Government factories, provided only that material of satisfactory quality for decolorising purposes can be produced in this country to meet the reasonable requirements of home consumers.

THE MANUFACTURE OF PHARMACEUTICAL PRODUCTS IN FRANCE.

That French manufacturers of pharmaceutical products are confronted with the same problems and difficulties as their British *confrères* is disclosed in a well-informed article by Monsieur A. Detoeuf in the February issue of *Chimie et Industrie*.

In discussing the future of this industry, M. Detoeuf states that the pre-war idea that the French were tributaries to Germany for the greater part of their pharmaceutical products did not quite correspond to reality. He points out that two distinct classes must be recognised among medicinal products, based on the existence or non-existence of patents and trade-marks which enable the manufacturer to defend his products against competition. The French patent law of 1844 at present in force excludes medicinal products, but in practice this restriction is often overcome by taking out a process patent to cover the preparation of a substance which is the eventual "raw" material of a medicinal derivative; and with regard to the trade-mark, it is well recognised that a simple denomination authorised for pharmaceutical products, which is renewable indefinitely, confers on its possessor an equally indefinite proprietary right.

By reason of these prerogatives there are two clearly defined classes of medicinal products:—(1) Those not protected by any mark and of which the manufacture has either never been covered by patents, or is now protected by patents; (2) those put on the market under a mark and of which the manufacture is also protected by patents.

(1) Practically all these products are listed in the official Pharmacopœia, and a large proportion of them was made in France before the war. Among the products belonging to mineral chemistry we find such important substances as potassium permanganate, corrosive sublimate and the bichromates of potassium and sodium. The manufacture of saccharin requires large quantities of permanganate, and this must be produced in sufficient quantity to meet all future requirements. Small quantities of corrosive sublimate have been made in France, although the manufacture depends, apart from the supply of mercury, on the available quantities of chlorine. No doubt the electrolytic works, now free from war restrictions, will soon be equal to meeting the entire home consumption. Bichromates constitute a very necessary raw material for the manufacture of many products, and a trial factory has been established in France during the war. This requires patient development in order to free France from foreign influence.

The following organic products—and these constitute the majority—were not made in France before the war, or were made in chemical works now destroyed:—Chloral, valerianic acid and valerianates, monochloracetic acid, oxalic acid and oxalates, phosgene, urea, morphine, codeine and derivatives, phenol, guaiacol and salts, benzoic acid and benzoates, saccharin, phthalic acid and phenolphthalein. With the exception of morphine and its derivatives and chloral (which were not manufactured for special reasons), all the other products named have been manufactured in France during the war. It cannot be said, however, that these have yet been produced under the most economic conditions, and it is therefore uncertain if the manufacture can be maintained. The production of nearly all these organic products depends upon a cheap supply of primary materials, such as mineral acids, caustic alkalis and chlorine. These materials are likewise used in the manufacture of aniline colours and synthetic perfumes, and it is in this whole field that development is needed, for the production of pharmaceutical products is only auxiliary to the manufacture of dyes.

It was principally from the German chemical dye works that pharmaceutical products were issued before the war. One great service which the war has rendered to France (and incidentally to Great Britain) is that it has made both nations producers of these primary materials at first hand. The factories that have produced for war must now produce for peace. Works that can produce electrolytic chlorine cheaply will be best able to make chloral, monochloracetic acid, benzoic acid and phosgene. The present makers of benzene and phenol can turn out guaiacol and its derivatives most successfully. From cyanamide, urea can be obtained; from toluene, saccharin; from naphthalene and oleum, phthalic acid; from amyl alcohol, valerianic acid; and so on.

But although it is necessary to encourage by all possible means the development of chemistry in France, it is no less indispensable to warn manufacturers that pharmaceutical products cannot be produced with a small plant and scant material. They require a perfected plant, the processes must be scrupulously attended to, and above all there must be facilities for disposing of the by-products to good account. "One does not manufacture a pharmaceutical product," says M. Detoeuf, "one manufactures all the products appertaining to the same series and dependent on the same crude material."

(2) It was by means of trade-marked or patented medicinal preparations that the Germans formerly invaded the French market. With the German manufacturer every new organic or mineral derivative was a potential material for a medicament. Intensive research in the factory laboratories and systematic experiment in their laboratories of therapeutic physiology, enabled them to recognise to a certainty such products as were endowed with special therapeutic activity. The process of manufacture was then patented in Germany, and if possible in France, no mention being made of therapeutic properties. Then the product was put on

the market under cover of a *marque déposée* and introduced to medical men.

The pre-war attitude of the French manufacturer was that if the German product had a small sale he left it alone. If, on the contrary, the sale developed the French manufacturer produced a preparation of the same chemical composition and put it on sale either under its chemical name or under another name chosen by himself. In every case the use of the German trade-mark was denied him as constituting an international industrial property. This explains why before the war only such products which could by their popularity justify the expense and risk of their production were manufactured in France.

Among the more important of the organic or mineral products sold under a German mark were:—Adalin, anæsthesin, antipyrine, aristol, aspirin, atophan, bismon, bornyval, bromipin, bromural, citrophen, collargol, creosotal, dermatol, dionin, diuretin, euquinine, helmitol, heroin, lactophenin, luminal, lycetol, lysol, salvarsan and neosalvarsan, novocain, orthoform, phenacetin, protargol, pyramidon, salophen, somatose, sulphonal, trional, urotropin, veronal, xeroform. Of these all except anæsthesin, atophan, bismon, bornyval, citrophen, dionin, helmitol, lactophenin, luminal, orthoform, phenacetin, salophen, somatose, sulphonal and trional, are now made in France.

In suppressing German competition, the war has made it comparatively easy to launch on the market, under a new trade-mark name, certain of these products which are still in demand among medical men. On the other hand, some French manufacturers before the war were able to secure by judicial action that certain marks which had become the usual name of the product (for instance, antipyrine, pyramidon, etc.) should be put into general use.

Two ways are open to French manufacturers: either they can reproduce chemically the German products and face the competition, or they may build up new compounds of proved therapeutic properties and place them before the medical profession. The difficulties of the task must not be overlooked. Well-equipped laboratories are necessary, manned by chemists trained to research, particularly in organic chemistry, and, above all, the possibilities of physiological experiment must be attended to. On the other hand, the industry in pharmaceutical products sold under a trade-mark requires usually but a small, though perfect, plant, and there is less risk of such trade being submerged by the dye and synthetic perfume industries.

M. Detoeuf's illuminating review of the situation shows quite clearly that the question of the manufacture of pharmaceutical products is not so simple or so attractive as is often believed. Newcomers, he says, will find themselves very quickly in the presence of difficult situations, and bitter competition awaits them, both at home and abroad. It is imperative, he concludes, that the laws now under consideration regarding patents and trademarks should ensure to these manufacturers sufficient guarantees for their enterprise without harm to the general interest. It is also necessary that they should be kept well informed of everything that is being done at home and abroad, and that official science should support them openly and without expectation of immediate reward. Finally, as the pharmaceutical industry, like other industries, has given the State all possible assistance during the war, it is the duty of the State to protect it now.

Rumania is taking active measures to free her industries from German influence. The Government has ordered the liquidation of all enemy enterprises established in the country during the German occupation.—(*Z. angew. Chem., Jan.* 28, 1919.)

NEWS FROM THE SECTIONS.

CANADA.

Toronto.

On March 20, Dr. A. J. Wilson, of the Department of Mines, Ottawa, gave an address on the production of potash in cement works in the United States and Canada.

Before the war a few cement works used dust collectors in order to protect the neighbourhood from fumes; now some fourteen factories are recovering potash from the collected dust as a part of their ordinary routine. Systems of electrical precipitation and spraying are used and very high efficiencies are claimed. The first plants erected have proved the most profitable as they were producing over a longer period of high prices. Others were not so successful, but it is expected that many of the plants will continue to treat their gases in this way as a means of doing away with a nuisance, and of reducing the cost of the cement by a few cents per barrel. The lecturer gave much information, which was released for the first time in Canada, regarding methods and types of plant, with dimensions.

In the discussion which followed it was brought out that prior to the war German interests had oversold the potash fertiliser market, and had developed the use of potash beyond the amount actually required by many Canadian soils under certain crops. Fertiliser users, therefore, had a small reserve of potash available in their soils. During the last year, however, the truck farmers have noticed the lack of potash more than others, and it is expected that Canada will offer a very large market for potash in the near future, provided the price is brought down to something like the pre-war level.

MANCHESTER.

There was an excellent attendance at the meeting held on April 4, when a paper was read by Mr. H. N. Morris on "The Industrial Development of India, with special reference to the Chemical Industries." The paper drew attention to and criticised the Report of the Indian Industrial Commission, 1916-18 (see this J., 1919, 50 R), but additional interest was imparted by the author's first-hand acquaintance with the subject. He urged the prompt and energetic carrying out of the recommendations in order to effect industrial stability, increased wealth and a higher standard of living, with their concomitants, greater purchasing power and increased demands for all kinds of goods. The meeting was attended by representatives from the Manchester Chamber of Commerce and by several Indian gentlemen, one or two of whom expressed their agreement with the author's views on the development of the resources of India, but pointed out that progress must necessarily be slow owing to the great lack of education among the mass of the people.

With reference to the report of the March meeting of this Section (this J., p. 102 R), we are informed that in the process of condensing the communication sent by Dr. J. Grossmann his views were unintentionally distorted, and we therefore append a *verbatim* version, coupled with an expression of regret that any mistake should have occurred.

"I have carefully considered the advisability of forming a Chemical Engineering Group in connexion with the Society of Chemical Industry, and as its work would come to a great extent under Section I of our classifications there appears to be no more

justification for its creation than for any of the other 22 Groups. It would confer no status on the members of the Group, unless the latter applied for a separate charter under which strict qualifications would be required for admission to membership. A desire for this appears to me to be the almost inevitable result, and as a loyal member I consider it against the interests of the Society of Chemical Industry to support such a dangerous precedent, which may ultimately lead to its disintegration. My personal view is that a chemical engineer should be a highly trained chemist with wide practical experience in chemical works, and particularly capable of designing plant for chemical work which cannot be obtained in the ordinary way. Such a person would naturally also have sufficient experience to select from manufacturers of specialities for his use in the designing and laying out of plant the best and cheapest means f producing steam, power, transmission, etc.

"Apart from these considerations, it appears from the membership application form which has been sent out by the Chemical Engineering Group that any foreman in a chemical works or any mechanical engineer with some knowledge of chemistry would be entitled to be classed as a chemical engineer."

LONDON.

At the meeting held on April 7, Dr. Charles A. Keane, the chairman, announced that the Committee of the Section had elected Mr. Julian L. Baker as chairman for the ensuing session, and that Dr. Stephen Miall had been re-elected hon. secretary and treasurer. In accordance with the suggestion made at the last meeting by Mr. S. G. Thomas, a committee had been appointed to report on Temperature Specification and Temperature Control in Refractometry. The annual meeting of the Section will be held on May 5. Dr. Keane also referred to the loss sustained by the death of Sir William Crookes.

Mr. E. A. Alliott read a paper on "Drying by Heat in conjunction with Mechanical Agitation and Spreading." The first considerations in drying, apart from the quantity of material to be handled, are the total amount of water to be removed and the degree of "dryness" to be attained, for the removal of the last portion of water is the most costly both as regards time and fuel. Driers may be classified either according to the method of heating employed (direct heat from a furnace, steam, hot water or hot air), or according to the method of working (stationary and "agitated" types). The type of drier to be selected is obviously governed by many factors. Besides those already alluded to, an important one is the "temperature sensitiveness" of the material, namely, the degree of temperature to which it can be subjected without injury. Perhaps even more important are the physical changes in the condition of the material during drying. In the case of film driers, some materials cling closely to the surface of the cylinder and require carefully designed scrapers for their removal. As the types of driers vary so widely and materials differ so much in the way in which they part with water, it is impossible to give any precise figure for the economy, but broadly speaking, the author considers that an evaporation of 4 to 5 lb. of water per lb. of fuel consumed, and an evaporation of 2 to 3 lb. per sq. ft. of heating surface per hour may be taken as representing fairly good practice. In this connexion the author gave illustrations of a number of types of driers and details of their performance. In the case of rotary driers, careful attention to the method of supporting the cylinder leads to economy in the power required for driving, a point which is often overlooked.

A very interesting demonstration was given of curves co-ordinating various factors operative in drying, such as the original moisture content and the time required to remove successive portions. The momentary rate at which water comes away at any particular degree of wetness varies in a curious manner. For example, with an initial moisture content of say 63 per cent. the rate at first may be nearly 90 lb. per hour. This rate falls rapidly to about 60 lb. per hour, at which point it remains constant for a wide range of moisture contents and below 12½ per cent. again falls away rapidly. Another important point in the economical working of driers is the temperature of the discharged air; at low temperatures a very large volume of air, even if half saturated, is required to remove water, and on the other hand the heat required to raise this temperature is by no means proportional to the total amount of heat involved. Some economy has, however, been effected by the application of the principle of "re-circulation," in which the air is withdrawn at a fairly high temperature from the drier, and a portion of this warm, moist air is again passed through the chamber, thus utilising the heat it carries and attaining the required degree of saturation. A type of rotary drier was also described which is fitted internally with a number of spiral volutes. The material is fed on to the periphery of the first spiral, and is carried up to the centre and passes to the centre of the next spiral, which is coiled in the reverse direction, and on reaching the periphery is caught by the next spiral. The material is prevented from falling off the spirals by interposed screens of wire gauze.

NEWCASTLE.

The annual meeting was held in the Bolbec Hall on April 9, Dr. J. T. Dunn presiding in the unavoidable absence of the chairman, Prof. P. P. Bedson.

The Hon. Secretary presented the annual report covering the past session. In addition to the enumeration of the papers which had been read before the Section, mention was made of the visits paid to various works in the neighbourhood. There had been an increase in the membership of 22 per cent., *viz.*, from 166 to 203. The average attendance at the recent course of lectures on Refractory Materials by Dr. J. W. Mellor had been 97. During the year the Section had been interested in the formation of a "Chemists' Club."

Dr. J. H. Paterson then read a paper on behalf of Mr. H. Blair and himself on "Electric Welding." In their introductory remarks the authors said that a great number of experiments in electric welding had been made by people with little or no scientific knowledge, with the result that many worthless processes and materials had been patented. He then dealt with the various methods adopted for improving the mechanical properties of welds, and he described in detail improvements in the procedure of determining nitrogen, and nitrogen and oxygen, in iron and steel. It was found very difficult in practice to get strictly concordant results from the same samples. Investigation showed that if any given sample of drillings were separated into three portions, coarse, fine and powder, the oxygen content varied very greatly. It was evident from the microscopic examination that there were considerable quantities of minute non-metallic inclusions in every weld, particularly when a flux-covered wire was used. Analyses of some large slag inclusions from a flux-coated electrode showed that they contained from 6 to 6·5 per cent. of oxygen which was removed as water when the slag was heated in hydrogen. No matter how samples were taken, the quantity of oxygen found must include

a certain amount which would have little or no effect upon the mechanical properties of the metal. Chemical analysis should always be supplemented by microscopic examination. The high percentage of nitrogen contained in the weld metal and the comparative uniformity of the amount was of great interest. It was a generally accepted fact that molten iron was practically unacted upon by the atmospheric nitrogen, and when it was remembered that the maximum time that the weld metal remained molten was about 30 seconds, it would be understood that the reaction which did take place was a powerful one. It was not unreasonable to suppose that the nitrogen existed in the metal in two forms, one form intimately related to the oxygen content and the other as a solid solution of iron nitride.

MEETINGS OF OTHER SOCIETIES.

PHYSICAL SOCIETY OF LONDON.

A paper on "Some Characteristics of the Spark Discharge and its Effect in Igniting Explosive Mixtures" was read by Messrs. C. C. Paterson and Norman Campbell on March 14. The object of the investigation was to determine the relation between the electrical characteristic of a spark discharge and its power of igniting explosive mixtures. The results show that the igniting power of a spark increases with both the capacity discharging and the spark potential, and that the energy required for ignition decreases rapidly as the spark potential increases. Various other properties of sparks were also described.

In the discussion Dr. Eccles pointed out that a given small quantity of heat is the more effective in promoting discharge the smaller the time and the mass in which it is developed, and the lower the thermal conductivity of the medium. The authors agreed with him that ignition takes place in two stages, the initiation of combustion and its propagation through the mixture, the latter stage being undoubtedly thermal, but probably not the former. Ignition is started by the development of a certain intensity of ionisation rather than by the development of a certain quantity of heat. This intensity may be produced by thermal, *i.e.*, thermionic, means, as when ignition is started by a hot wire, and possibly when started by a flame; but it may also be produced by ionisation by collision or the action of ionising rays. The first of these means is probably employed in the spark discharge, and the second when the ignition is started by the incidence of *X*-rays on a metal plate.

INSTITUTION OF SANITARY ENGINEERS.

On March 17, Mr. W. C. Easdale described a method of sewage disposal which was adopted during the war to treat the sewage from a large military camp near the River Swale, a tributary of the Yorkshire Ouse. The main objects of the scheme were to remove a maximum percentage of suspended solids, to maintain the sewage in a fresh condition while passing through the tanks, and to obtain an innocuous tank effluent. These aims were successfully attained owing to the effective design of the tanks employed and to the very favourable natural conditions, *viz.*, excellent gradients, very fresh sewage, uniform flow, and a highly oxygenated river water.

The sewage passes through a screen chamber into four tanks, each divided into three compartments (A, B, C). The width of A and B is twice that of the length in the direction of the flow, and the floor of each is steeply inclined. The sewage enters A near the bottom, flows down and across it, up under a baffle board and out over a long weir into B, from which it passes over another long weir into the effluent channel. The solids, the bulk of which is deposited in A, are discharged by gravity once weekly into C, which retains the sludge until digestion is complete. C is much larger than the others, and the bottom is shaped like an inverted cone, the greatest depth being 15 ft. The sludge accumulates in it to a depth of 6 ft., at which height it is discharged, once a month, through a horizontal pipe connected to a vertical stand pipe extending from the bottom of the cone to the top water level. It is dried on drying beds and applied to the land (H_2O 72%, N 0·9%). The supernatant liquid in C is returned to the fresh sewage.

The few analytical figures given showed that, roughly, 70—80 per cent. of the suspended solids is removed in A and B, and that the percentage of purification, as given by the 5-minute permanganate test of the effluent, is 30 to 48, the effluent being purified by chlorination. At a point 300 yds. below the outfall the dissolved oxygen content of the river water was found to have fallen about 50 per cent., but 1½ miles lower down it was again normal. From the bacterial standpoint, the effect of adding 4·5 pts. of chlorine per million of effluent was satisfactory when the ratio of dilution was high, although the destruction of *B. coli* was not complete: 1½ miles below the outfall the bacterial contents of the river were again normal.

ROYAL SOCIETY.

A paper "On the Inter-crystalline Fracture of Metals under prolonged Application of Stress" was read by Dr. W. Rosenhain and Mr. S. L. Archbutt on April 3.

The authors' observations have shown that in a number of metals, including lead, mild steel and an alloy of aluminium with zinc and copper, the prolonged application of stress will, in certain cases, produce an abnormal type of fracture in which the crystals become separated from one another, instead of being broken or torn across in the normal manner. An exact similarity to this type of fracture is found in the "season cracking" of brass. In the latter case the applied stress is an internal one arising from elastic deformation. The authors base an explanation of this type of fracture on the hypothesis, formerly advanced by one of them and widely accepted among metallurgists, that the constituent crystals of metals are held together by thin layers of an amorphous inter-crystalline "cement," whose properties resemble those of a greatly under-cooled liquid. When stresses are applied to such an aggregate, the viscous under-cooled liquid films behave, in the first instance, like a very strong and hard material (somewhat resembling glass), and when fracture is brought about at any ordinary rate it occurs by the failure of the crystals themselves and not by the tearing away of one crystal from another. Under the prolonged action of stress, however, the viscous cement will, in favourable circumstances, yield slowly, so that the crystals become detached from one another. Whether this will occur or not must depend upon the character of the inter-crystalline boundaries; if these are rough and irregular, viscous flow will be prevented, but if they are very smooth it will be facilitated. The authors' observations show that in the cases where inter-crystalline failure occurs the metal has been subjected to some annealing process which has allowed the crystals to acquire smooth, regular boundaries; where such smooth boundaries do not exist this type of failure is not met with. The practical importance of avoiding such "over-annealing" is pointed out. As the viscosity of a liquid rapidly decreases with rising temperature, it would follow that inter-

crystalline failure of this type will be favoured by a slight rise of temperature; this is known to be the case with brass, and the authors point out that cases of inter-crystalline cracking in steel have mainly been met with in the plates of steam boilers working at high temperatures.

SOCIETY OF PUBLIC ANALYSTS.

The first paper read at the meeting held on April 2, Dr. S. Rideal presiding, was "A Method for the Determination of Monochlorbenzene in Mixtures containing Benzene, Monochlorbenzene and Dichlorbenzene," by Messrs. N. G. S. Coppin and F. Holt. The method is based upon Northall-Laurie's method of determining toluene in commercial toluols (this J., 1915, 950), and consists in distilling, at the rate of 7 c.c. per minute, 200 c.c. of the dried sample, and determining the boiling points of the first distillate of 50 c.c. and of the residual 50 c.c. in the flask. The percentage weight of the constituents is then read off from a graph. The method gives direct results with an accuracy of 0·1 per cent. for all mixtures containing from 50 to 100 per cent. of monochlorbenzene.

In the second paper, on "The Electrical Conductivity of Milk," Messrs. J. H. Coste and E. T. Shelbourne drew the conclusion that the conductivity is not sufficiently well defined to be useful as an analytical datum except for milks which have been examined by this means before incurring the risk of dilution. They have examined the relation between conductivity and temperature, non-fatty solids, ash, chlor-ion content and free acid, and the effect of dilution, and the results obtained are consistent with the explanation given by L. C. Jackson and A. C. H. Rothera, that the conductivity is dependent on the extent to which the constant osmotic pressure of milk is due to electrolytes with which the milk sugar is complementary.

The last paper, "A Note on Soluble Lead in the Glaze of Casseroles," by Miss H. Masters, stated that a number of casseroles of various types were found to yield considerable proportions of lead on treatment with 4 per cent. acetic acid, and with dilute solutions of other acids such as would be present in certain cooking operations. The soluble lead is not all extracted by one operation, but after two or three treatments, each subsequent treatment appears to yield a fairly constant quantity.

THE CERAMIC SOCIETY.

At the meeting held on April 14 at Stoke, Dr. J. W. Mellor contributed a short paper on "The Heat Conductivity of Porous Materials and the Heat Insulation of Kilns." In 1914 the author called in question the commonly held view that at high temperatures porosity favours insulating properties. In ordinary circumstances the quantity of heat travelling by conduction through the solid material is much greater than that passing by radiation across pore-spaces, but for a given size of pore there is a particular temperature at which the two quantities of heat will be equal. According to a calculation by Dr. Mellor, if the pores are 0·1 cm. across, the heat carried across the air spaces per second at a temperature of 1400° C. is equal to the heat conducted through the solid material. With pores of 0·5 cm. the temperature is about 730° C., and with pores of 0·01 cm. the temperature would be about 3000° C., and so on. In these calculations the conductivity of air and change of conductivity with rise of temperature and the effect of convection of heat by air currents in the pore spaces, are ignored.

It would seem therefore that the temperature of the breaking down of the insulating properties—when the radiated heat equals the conducted heat—falls within ordinary kiln temperatures. A pore size of 0·01 cm. would not constitute a really porous material. In order to test the point experimentally, bricks having different degrees of porosity, etc. were prepared, with three holes extending different distances into the length of the brick. By inserting thermo-couples into the holes, the temperatures at different points of the bricks can be ascertained. The work is being carried out by Messrs. C. Edwards and A. Rigby, and the results will be presented in a subsequent paper.

A paper on "Apatite substituted for Bone Ash," read by Mr. N. B. Davis, dealt with the possibility of using Canadian apatite in place of bone in the preparation of English bone china bodies.

A third paper on "The Casting of Heavy Pottery" was read by Mr. B. J. Allen. This concerned the casting of such objects as glass pots, articles of fireclay like basins etc., and smaller special articles like high tension electric insulators. The author claims that pieces made by his vacuum process are much drier on leaving the mould, and contain more clay in a given space, than with any other commercial process.

NATIONAL ASSOCIATION OF INDUSTRIAL CHEMISTS.

A meeting was held in London on March 31 to hear an address by Mr. G. H. Todd, representing the Ministry of Labour, on the subject of the Whitley Councils, with special reference to the position of technical and scientific workers. In describing the Whitley Scheme, Mr. Todd pointed out that the Ministry of Labour had no mandatory powers thereunder. No provision is made under the Scheme for unorganised elements, representation being based entirely on association either as employers or employees. The association on the side of the latter is not necessarily that of a trade union. The only way for scientific and technical workers to obtain representation is by organising and agitating. The Ministry of Labour will do its best to further the demands of these workers, but they must take the first step. Replying to questions, the speaker said that it was of no importance to the Government whether these workers were registered as a trade union or not, but existing trade unions would not recognise them unless they were so registered. The difficulty of deciding whether an association should obtain representation as employers or employed might be solved by introducing into the Whitley Councils a third body representing scientific and technical workers. He thought that the Ministry would favour this suggestion.

The president, Mr. A. C. Charlier, said he was a convert to the policy of registering as a trade union, but that did not mean that trade union methods should necessarily be adopted. Before all, it was essential that the four or five bodies now acting separately should federate and show a united front. Mr. N. Wild, secretary of the Society of Technical Engineers, also addressed the meeting, and spoke in favour of organisation of all technical workers and of federation of the different groups.

INSTITUTE OF CHEMISTRY.

At a meeting of the Birmingham Section, held on April 7, Dr. E. W. Smith presiding, the functions of the Industrial Research Laboratory of the Gas Department of the Birmingham Corporation were considered. It was generally agreed that a municipally-owned research laboratory would fill a necessary want if restricted in its activities to matters which could not satisfactorily be dealt with by the well-established consultant chemists, and on lines approved by the Institute of Chemistry.

L'ENTENTE CHIMIQUE.

STEPHEN MIALL.

Monsieur P. Kestner and his colleagues have a genius for hospitality and organisation, and of this the recent conference of allied chemists in Paris is a striking piece of evidence. Not only was the gathering representative of most of the allied nations, brought together under circumstances of considerable difficulty, but every detail had been thought out in such a manner as to secure the convenience and happiness of the guests, and to provide them with a delightful and lavish reception which will long remain among their most cherished recollections. The delegates who were privileged to attend were from the outset made sensible of the kindly consideration which their French colleagues had shown in connexion with the important matters to be discussed, and it was obvious that a real effort was being made to deal with inter-allied co-operation in an adequate and worthy manner.

No one can suppose that a true co-operation can be established without plenty of hard work extending over a considerable period of time. A good deal of drudgery and attention to points of detail will be necessary and much time and trouble must be taken before real progress is made. To harmonise the views of several nations, speaking different languages, with different traditions, different points of view, different ways of looking at a problem, and a score of other differences, will be no easy task. But there is no doubt that the work can be done, must be done, and that this is the time to do it. France is in the position of requiring from her own government and from the allied countries a greater measure of encouragement in chemistry, both pure and applied, than other countries, and when we consider what France has done to preserve civilisation in Europe, we shall all be glad to see her make her position unassailable and outstanding in a science in which she has already taken so prominent and worthy a part. We must bear in mind that France has made far heavier sacrifices in the war than Britain or America and some other of the allies, and has had a heavier toll taken of her manhood and her wealth, and that consequently she will have to make, and undoubtedly will make, a greater effort to maintain the place she so well deserves in the chemical world than those nations whose geographical positions have enabled them to escape the devastations and losses which have fallen on her. Her geographical position and her close association with Belgium, Italy and Greece will probably make France the dominant partner in the new confederation. The impression left on one's mind is that the headquarters of the inter-allied chemistry will be at Paris and the diplomatic language of chemistry will be French. The English delegation was fortunate in including two or three who had a fluent knowledge of that language.

The Inter-allied Conference was presided over by Prof. C. Moureu and was fully attended. Among the French were Messrs. Kestner, Haller, Béhal, Poulenc, Hanriot, Marquis, Matignon, Marie and Gérard. The British deputation consisted of Prof. H. Louis, Sir William Pope, Messrs. Chaston Chapman, W. F. Reid, E. Thompson and S. Miall. The Americans included Mr. H. Wigglesworth, Lt.-Cols. Bartow, Norris and Zanetti, Major Keyes and Dr. Cottrell. Italy was represented by Senator Paterno, Doctors Pomilio and Giordani and others, while M. Chavanne represented Belgium. The first sitting took place on April 14 in a delightful room at the Hotel du Comité des Forges, and the thirty or so delegates sat round an oval table "too large to be conceived by any narrow mind."

Les Etablissements Kuhlmann gave us lunch at the Restaurant Laurent, and appropriate speeches were made by M. Kestner and M. Agache, after which we settled down to more serious business. Professor Louis read a paper on the magnetic separation of low grade iron ores; he did not profess to give us much new matter but he provided a convenient and useful summary of the processes now in vogue, some of which had been of great importance during the war. Dr. Cottrell's paper on the industrial production of helium was full of interest, and it is evident that a few weeks or months hence it should be possible to give a more complete account of this important investigation. In the discussion which followed a remarkable feature was mentioned by Professor Moureu. He stated that in France the rare gases, neon, krypton, xenon and helium were invariably present in the gases given off by springs and underground waters, and that although the proportion of helium was variable, the relative proportions of neon, krypton and xenon and of nitrogen were fairly constant. A possible explanation was suggested, *viz.*, that these four gases were all present in the nebular mass from which the earth was formed, and that nitrogen being nearly inactive and neon, krypton and xenon absolutely inactive, their relative proportions had remained the same to this date. On the other hand helium was continually being formed by radioactive minerals, which would account for the variations in the proportion of this element.

Good progress was made on April 14 and 15 in the organisation of an Inter-allied Federation for Pure and Applied Chemistry. It was made quite plain from the commencement that none of those present had any power to bind the organisations which they represented and that the decisions which, after considerable discussion, were unanimously agreed to would require to be remitted to the appropriate bodies for ratification.

The following resolutions were passed :—

1. The members of the Inter-allied Conference of Chemical Associations held on April 14 and 15, 1919, unanimously accept in principle the formation of a Confederation of Chemical Associations both Pure and Applied.

2. They express the hope that the Associations of each allied country will form National Federations or National Councils, and invite them to communicate their adhesion at the next meeting of the Conference which will be held in London on July 15—18 next.

3. They contemplate in due course affiliation with the Associations of the neutral countries.

4. A Committee is appointed on behalf of the Conference to draw up a general programme of organisation with power to consult Associations of allied countries not represented at the Conference.

5. This Committee should provisionally act as the Council of the Confederation, its power being limited to the carrying out of the decisions taken by the Conference.

The following regulations were also agreed to :—

1. The Confederation has for its aim to consolidate the bonds of esteem and friendship between the different allied countries which have already been strengthened during the war; to organise a permanent co-operation between the associations of the federated countries; to co-ordinate their science and technology and to contribute to the advancement of chemistry in all departments.

The Confederation will be governed by a Council whose members alone shall have power to take decisions.

2. Each nation shall be represented by not more than six members.

3. The members of Council shall be nominated for three years and one-third shall retire annually.

4. Members of Council shall be eligible for re-election.

5. The executive power of the Council shall be in the hands of officers, consisting of a President, Vice-President and General Secretary.

6. The officers shall be chosen annually by the representatives of each federated country in turn.

7. The International Council shall fix the date and place of meeting and have control of the expenses.

8. A permanent Secretary shall be appointed to carry out the decisions of the Council and have custody of the archives.

9. There shall be appointed in addition to the Council, a consultative committee formed from as many sections as are necessary to ensure complete representation of pure and applied chemistry.

10. In each section the various federated nations shall be represented by not more than six members.

11. The members of the committee shall have merely a consultative power and the right to make suggestions.

12. The reports of the committee shall be laid before the Council and distributed to the members thereof at least one month before discussion.

The original resolutions are not perfectly clear and consistent and the above translation has doubtless additional faults, but time and further consideration will remove both sets of defects.

The Society of Chemical Industry had the pleasure of inviting the Inter-allied Federal Council to meet in London on the occasion of the Society's annual meeting in July next and the invitation was accepted in the most gratifying manner. We hope to welcome six delegates each from France, America, Italy and Belgium and to continue the conferences so pleasantly begun in Paris. The French have set up an extremely high standard for such a welcome, a standard impossible to surpass and to which it will be very difficult to attain. We gladly accept the responsibility, relying on the co-operation of the British chemists to enable us to come out of the ordeal with credit.

No cut-and-dried programme for the future has been prepared and it is in the hope of receiving suggestions and criticisms that the following crude ideas are put on paper.

The Inter-allied Confederation or Council will be the guests of the Society of Chemical Industry and will be welcome at our conferences, discussions and social gatherings; nevertheless they will have to proceed with their organisation and hold their own meetings; suitable arrangements must be made for the conduct of their own special business. These meetings will require the occasional presence of the Society's President, and, perhaps, of other members. Special hospitality must be provided for the distinguished allies who attend, and though the annual meeting of the Society will derive additional importance and gratification from the Inter-allied Conference, the provisional programme now being drawn up will require a little amendment. It will apparently be the business of the Federal Council for Pure and Applied Chemistry to nominate the six members who shall represent Britain on the Inter-allied Council, and the arrangements for the Inter-allied Conference so far as Britain is concerned will be under the supervision of the Federal Council. The latter will probably be asked to appoint a small committee who will ensure that the Secretary of the London Section does not neglect due provision for the Inter-allied Council.

Space does not permit of an adequate account of the luncheon given by the Société Solvay et Cie, at which M. Talvard presided, nor of the banquet at the Palais d'Orsay with M. Loucheur, Minister of Industrial Reconstruction, in the chair. At this, in addition to the various delegates, a number of men well known in the chemical world were present including Lord Moulton and Dr. Herbert Levinstein.

On April 16, the delegates visited Chauny and were shown round the ruins by the Compagnie de Saint-Gobain whose works were destroyed at the same time as the rest of the town. This area was the scene of some fighting but the destruction was not caused in the fighting; it was a cold-blooded piece of work with two objects in view, one to make the country uninhabitable for the French when the Germans were driven out, the other to put an end to the industry there carried on, for the benefit of their German competitors. For about three weeks the Germans carried on their work of desolation, removing everything of value, blowing up the buildings, burning anything which would burn, smashing up any machinery which they could not carry away, and reducing a pleasant and prosperous little town to a deserted heap of ruins. We were told that many towns and villages in the district met with a similar fate. It was a most impressive sight and helps us to realise the unchanging attitude of the French, a nation whom our ignorant forefathers considered fickle and volatile. Some day the Peace Conference will finish its labours; the cities will again be held by their ancient masters, cities that hostile hands have utterly spoiled; the people will till the flowering fields and gather in the crops, and spiders weave their delicate webs over helmet and rifle. Since Sicily was devastated by the Carthaginians in B.C. 265, poets and idealists have dreamed of an enduring peace. It may be that this is now commencing; for the French it is a question of " Once bit, twice shy." They have no faith in their eastern neighbour and they fail to see any justice or common sense in allowing the Germans to utilise stolen French material with which to build up business, while their own salt pans and sugar refineries lie in fragments.

And if some time in the future, in our insular way, we are inclined to regard some problem which concerns both France and Germany rather from our standpoint than from the French, let us remember the barbarous destruction of Chauny and the great stretch of country similarly devastated. The people who did this were the Boches, which explains though it does not excuse their conduct.

NEWS AND NOTES.

CANADA.

New Manufactures.—Amyl acetate and refined fusel oil are being manufactured, for the first time in Canada, by the Cosmos Chemical Co., of Port Hope, Ontario.

Mining News.—*British Columbia.*—The Temiskaming Mining Co., of Cobalt, Ontario, has announced that it has taken over the Dolly Vardon and Wolfe silver properties in Northern British Columbia. The price paid was $1,350,000.

The position of the copper producers is an anxious one at the moment. About 60 per cent. of the total labour employed in the metalliferous mines is engaged in mining copper ore.

An International Mining Convention was held on March 17—19, which was attended both by technical and business men, with the object of arranging for the future development of the many valuable mineral resources known to exist in the province.

Western Provinces.—It is anticipated that the coming summer will see great developments in the

exploration of the copper deposits in Northern Manitoba, and in connexion with oil, gas and tar sand prospects in Saskatchewan.

AUSTRALIA.

Australian Metals.—In his recent Budget speech, the Federal Treasurer of the Australian Commonwealth referred to the sale to the Imperial Government of 300,000 tons of zinc concentrates annually. The Commonwealth's production of lead amounts to about 175,000 tons per annum, and the exportable output of this also had been sold to the British Ministry of Munitions, with the exception of lead for the markets of the East. The surplus of the copper output has been disposed of similarly. In future all Australian tin ores and concentrates will be smelted in the country, an embargo having been placed on their export. The Australian output of wolfram, scheelite and molybdenite has been acquired by the Imperial authorities; the production of these ores has increased almost 100 per cent. compared with 1914. The production of antimony has not advanced as it should have done, but the output of bismuth is well established.—(*Iron and Coal Tr. Rev., April* 4, 1919.)

BRITISH INDIA.

Cinchona Cultivation.—The Director of Botanical Survey for India has recently visited Burma to ascertain if a suitable locality could be found for the cultivation of cinchona on a large scale. His report will be published in due course.

Chemical Industry in the United Provinces.—Strenuous efforts are being made to develop the industries of the United Provinces. The Director of Industries is very hopeful as to the prospects of the leather industry, which is at present suffering from difficulty in obtaining suitable tanning materials, but arrangements are being made to establish factories for preparing extracts from barks and leaves. Several new glass works have come into existence during the war, and skilled glass blowers are being engaged. The progress of the match industry is disappointing owing to dependence upon foreign chemicals. Much of the work devoted to dyes and fine chemicals is of a routine character, and it is considered doubtful if the attention given to vegetable dyes will prove to be profitable owing to future competition with synthetic colours. The Government is also directing its attention to the manufacture of essential oils, and arrangements have been completed for the installation of a plant for comparatively large scale experiments on the production of oils and perfumes from raw materials available locally. Attempts have already been made with some success to prepare sodium carbonate and caustic soda from natural saline incrustations found in abundance in the province.

Blast Furnaces in Bengal.—The Indian Iron and Steel Company, Ltd., of Calcutta, has decided to erect at Asanol, in the Bengal coalfield, two 350-ton blast furnaces, a by-product cokery with a daily output capacity of 1000 tons, and a plant for the manufacture of sulphuric acid required in the recovery process. The by-product plant and the power plant will be obtained from England, but the contract for the blast furnaces has been placed with a Cleveland firm in the United States.—(*Iron and Coal Tr. Rev., April* 4, 1919.)

SOUTH AFRICA.

Spearmint Oil.—A sample of *Mentha longifolia* was recently examined by the Imperial Institute, which reported that the leaves gave on distillation with steam 2·4 per cent. of volatile oil, equivalent to a yield of 0·98 per cent. from the entire original sample as received. The oil was mobile and colourless, and had the characteristic odour and taste of spearmint oil; chemical examination showed it to be similar to English and American spearmint oil, but to contain a higher percentage of ketones than these oils. The report adds that there is little doubt that the oil would be saleable as spearmint oil.—(*S. Afr. J. Ind., Jan.*, 1919.)

Magnesite.—The Imperial Institute has also reported upon a sample of South African magnesite, which, it states, compares very favourably in composition with Grecian magnesite, except in the proportion of silica present. The analytical figures obtained were:—MgO 45·65%, CaO 0·63%, Fe_2O_3 0·22%, Al_2O_3 0·13%, SiO_2 3·27%; CO_2 50·00%. The best commercial magnesite from Greece contains about 1·5 per cent. of silica, and the poorer qualities about 2·5 per cent.—(*S. Afr. J. Ind., Jan.*, 1919.)

Resin.—There has recently been forwarded to the Department of Industries a sample of resin obtained in the process of sifting seed of the Oyster Bay pine, with the suggestion that its commercial value, if any, might be ascertained. It is stated that a large old tree yields from one to five pounds of resin with several pounds of seed, and that, though the demand for the seed is limited, it might be found a commercial proposition to cultivate the tree for the resin it yields as well as for its timber. Local investigation has shown that about 17 per cent. of the resin is insoluble in alcohol, and that the solution, on evaporation and after gentle heating, leaves a brittle resin which is not easily fused to a liquid and is not ordinary resin. A sample of the resin has been forwarded to the Imperial Institute for examination, the results of which will be published in due course.—(*Official.*)

UNITED STATES.

Research.—The intention of many manufacturers to engage in research to a greater extent than before is shown by the much increased demand for well-trained research chemists and a corresponding decrease in the call for junior men. There is also an encouraging tendency towards better co-operation in research.

Potash from Kelp.—Since the signing of the armistice it has become evident that the production of potash from kelp is another example of an industry which cannot exist in normal times unless it can also produce marketable by-products. Several of the Pacific coast factories have closed down. While in some cases the situations chosen for them were bad, and in others crude methods were employed, even those works which are well managed and have successfully produced potash will be dependent upon the successful exploitation of by-products.

Gas Masks.—The army gas mask has had such wide publicity that the majority of people has come to consider it as a sure protection against all kinds of gases and dusts. It has become advisable, therefore, for the United States Bureau of Mines to inaugurate an educational campaign on the industrial uses and limitations of gas masks, respirators, and similar devices. At the same time extensive research is being undertaken on breathing appliances with special reference to the mining and metallurgical industries, and to underground conditions.

Recovery of Wax from Waxed Paper.—Work just completed at the Forest Products Laboratory shows that oils and paraffin may be economically recovered from waste waxed paper by extraction with a volatile solvent, leaving the pulp in condition for re-use. Extensive experiments with steam and hot water failed to produce pulp free from wax and

oil and showed a prohibitive cost. At present there is just sufficient waste in wax paper mills to support one central recovery plant, but as the use of the paper increases it may be possible to erect others to serve different localities.

Concrete Protection.—The principal methods of protecting concrete were discussed at the Chicago meeting of the American Institute of Chemical Engineers. These methods are seven in number and include: (1) Applying a membrane, such as a fabric, with the aid of tar or asphalt; (2) application of a neutral hydrocarbon by means of a brush or spray; (3) use of an acid resin which reacts with the lime to form an integral part of the surface; (4) use of a dry powder to obtain greater density in concrete; (5) addition of a powder to the concrete to make it acid- and alkali-proof; (6) precipitation of silica into the pores of the concrete by the use of silicofluoride; and (7) use of two solutions which interact to precipitate an insoluble substance into the pores, thus preventing the penetration of water and other substances. According to the author of the paper, Dr. M. Toch, several of these methods are often combined.

New Process for Manufacture of Sulphonic Acids.—There has been developed at the Colour Laboratory of the Bureau of Chemistry of the U.S. Department of Agriculture a new and promising process for the sulphonation of benzene, naphthalene, and other hydrocarbons in the state of vapour. It is believed that the process will be of value to manufacturers of chemicals and dyestuffs, and the chemists of the Colour Laboratory are prepared to give expert advice to those who adopt the process.—(*U.S. Com. Rep., Mar.* 11, 1919.)

New American Dye Trust.—A new body, known as the Chemical Foundation, has been organised in New York to fight the German dye trust. One hundred and fifty leading manufacturers have already been enrolled. The association is being modelled on the one now in operation in Allied countries, the purpose being to secure the licensing of certain dye imports and the exclusion of dyes reasonably obtainable in the United States. The Government has seized 4500 German patents, and the Foundation has bought these for $250,000.—(*Manch. Guard., April* 7, 1919.)

Ferro-manganese.—Before the war the supply of ferro-manganese was largely in the hands of British producers, and the output found a considerable market in the United States. When war broke out American steel interests were faced with serious conditions, and they set out to make themselves entirely independent of foreign supplies. The result is the establishment of a new industry, which has developed on a considerable scale. From a domestic output of less than 10,000 tons a month in 1913, American production of ferro-manganese is now about 25,000 tons a month, the supply of manganese-iron alloys being now in excess of the demand.—(*Iron and Coal Tr. Rev., April* 4, 1919.)

Reclaiming Waste Material.—The saving and reclaiming of waste material in the United States was carried out during the war by the Department of Commerce. It is estimated that in 1918 waste material to the value of $1,650,000,000 was reclaimed in the United States. This sum includes 600,000,000 dollars' worth of scrap iron and steel, and 300,000,000 dollars' worth of scrap non-ferrous metals. A new service is now to be organised on a permanent basis; but it will not initially include the salvaging of organic material, which is now under the direction of the Food Administration. The annual value of reclaimed waste is expected to reach $2,000,000,000 when the service is fully organised.—(*Manch. Guard., April* 2, 1919.)

GENERAL.

The Index to the Journal.—The Index to Volume 37 (1918) is being posted to members and subscribers with the current issue of the Journal. In addition to the combined index of the three sections, there is also included a special index to the Review to be used by those who may desire to have it bound separately. The Journal is steadily increasing in bulk and will doubtless soon become too unwieldy to handle as one volume; hence it has been considered advisable to provide means for facilitating the natural cleavage into "Review" and "Transactions and Abstracts."

Standardisation of Aircraft Materials and Parts.—It may not be generally known that during the past year and a half the British Engineering Standards Association has been responsible for the preparation of all specifications for aircraft materials on behalf of the Department of Aircraft Production. Particularly interesting have been those specifications dealing with materials which formerly were perhaps not considered as being of an engineering nature, such as chemicals used as ingredients for aeroplane dope, rubber, textiles, adhesives, paint and varnishes. Owing to the extremely useful part these specifications have played, it is now learned with considerable satisfaction that the British Engineering Standards Association has been requested to continue to prepare them as well as to undertake their distribution, together with the issue of manufacturing instructions and notes on testing procedure which were formerly prepared and issued by the Technical and Inspection Departments of the Department of Aircraft Production. The Association has undertaken this additional responsibility as from March 31, 1919.

New Salt Deposits in Holland.—The Royal Dutch Salt Industrial Company in Amsterdam, floated last year with Government help to alleviate the salt shortage in Holland, has found its first salt deposits near Boekelo at a depth of 325 m.—(*Deutsch. Allgem. Z., Mar.* 20, 1919.)

Discovery of Fluorite in Switzerland.—Prof Wehrli of Zürich has found a large deposit of fluorite in a disused lead mine near Sembrancher in Canton Valais. This mineral has hitherto always been imported, chiefly from Silesia.—(*Z. angew. Chem., Feb.* 25, 1919.)

Gold Discoveries in Siberia.—A telegram from Omsk reports that gold-bearing reefs have been discovered near the source of the River Angara, a tributary of the River Yenisei. It has also been ascertained that the River Titumen, which flows into the Aldan River, contains much alluvial gold. —(*Manch. Guard., April* 5, 1919.)

"Minette" Ore for Westphalia.—The French have promised to the Rhenish-Westphalian foundry industry the monthly delivery of 250,000 tons of minette iron ore from Lorraine, but it is doubtful whether delivery can be made immediately.—(*Weltwirtschaftszeit., Mar.* 7, 1919.)

Salt Production in Norway.—Works for obtaining salt and other products from sea-water are to be built on the island Osteröen, near Bergen. The first installation will have a production of 60-70,000 tons of crude salt per annum, and is to be finished by the end of the year, the capital expenditure being estimated at about £500,000. Electric power will be supplied from a large municipal power-station now in course of erection (*cf.* this J., 1918, 349 R).—(*Teknisk Ukeblad, Jan.* 31, 1919.)

Supplies of Fertilisers in Norway.—According to the Norwegian Agricultural Department, the following supplies of artificial fertilisers will be available in 1919:—Synthetic nitrate (Norwegian), 80,000

tons; cyanamide, powdered, 2500 tons, granulated 2500 tons; superphosphate, 43,000 tons. No information is given in regard to potash. The amount of the Government subsidies for synthetic nitrate production is estimated at 13·6 million kronen (£765,000) for 1918-19. Unlike potash and superphosphate, artificial nitrogenous fertilisers are not rationed.—(*Deutsch. Allgem. Z., Mar.* 19, 1919.)

Oil Shale in Sweden.—Two concessions covering an area of 1100 hectares have been granted for the exploitation of the very valuable oil shale deposits. Operations are to start almost immediately under the direction of mining engineer J. H. Nathorst.—(*Sydsvenska Dagbladet, Feb.* 8, 1919.)

Use of Peat Fuel on Swedish Railways.—Coal has been almost unobtainable, and substitutes produced in the country have been pressed into use. Many railroads resorted to wood-firing without any alteration to the locomotive other than the removal of the air inlet valve on the fire door. Some lines have used 34 per cent. birch mixed with 66 per cent. of air-dried peat briquettes, but such fuels have the disadvantage of emitting large quantities of sparks. Experiments made with mixtures of coal and peat showed that the addition of 50 per cent. of peat decreased the pull on the drawbar, and that they could only be used for trains with a speed not exceeding 31 miles per hour. By the "Ekelund" system of using powdered peat, introduced in 1890, the calorific value is used to better advantage than is possible with briquettes. The first trials were not altogether satisfactory, but the Swedish Government took the matter up in 1916 and voted £72,000 for a peat-powder factory, to produce 20,000 tons per annum. A number of locomotives are now using peat powder as fuel. The analysis of the powder is:—Moisture 16·16%, ash 4·55%, sulphur 0·18%, combustible matter 79·11%. The calorific value, exclusive of moisture, is 10,040 B.Th.U. per lb., but as fired gives only 7,780 B.Th.U. The cost before the war was about 9*s.* 6*d.* per ton, at present it is nearly 25*s.* It is estimated that it will not be economical to use peat powder for locomotives when coal can be purchased at 55*s.* 6*d.* per ton. —(*Teknisk Tidskrift, Feb.* 1, 1919.)

The Mineral Wealth of Germany.—A recent issue of the *Vossische Zeitung*, quoted in the *Board of Trade Journal* of March 27, contains the account of a lecture by Prof. Beyschlag on Germany's mineral wealth and her dependence on foreign minerals. Prior to the war, Freiberg had produced 5·2 million kilo. of silver to the value of about 1 milliard marks. The hopes placed in the gold and platinum discoveries in parts of Germany have proved disappointing, since the low percentage extraction obtained made exploitation unprofitable. This also applies to tin, nickel, chrome, wolfram, molybdenum, and vanadium. The tin deposits in the Erzgebirge had formerly sufficed for German needs, but before the war the annual consumption of tin had amounted to 19,500 tons, 11,500 tons of which was foreign tin smelted in German works. Germany possesses practically no quicksilver, asbestos, or mica, and only inadequate quantities of copper, lead, tin, iron, and manganese. In prewar days, Germany consumed 260,000 tons of copper annually in her manufactures, but only produced 25—30,000 tons herself. During the war aluminium was used as a substitute for one-third of the copper requirement. Tin could also serve as a substitute. Germany's iron production has been severely threatened through the loss of the war, and France will now become the richest iron country in Europe. The German potash monopoly has also been destroyed by the war. As regards fuel, Germany possesses 140 milliard tons of coal, and 13·9 milliard cbm. lignite. Prussia alone possesses 2 million hectares of peat land, which represents sufficient power to meet industrial requirements for 750 years.

Output of Benzol in Spain.—According to a writer in the *Boletin Oficial* of the Ministerio de Fomento, the annual output of benzol in Spain before the war was 1150 tons, produced by four different firms. Three new plants have since been erected, and two of these are approaching completion. The production in 1918 was 2000 tons, of which 660 tons was secured by the Ministerio de Abastecimientos to satisfy urgent national demands.—(*Iron and Coal Tr. Rev., Mar.* 21, 1919.)

Iron Ore Resources of Spain.—A recent issue of the *Revista Industrial y Financiera* estimates the total reserves of Spanish iron ore at 700 million tons of an average iron content of 50 per cent. The largest deposits are situated in the districts of Léon (150 million tons) and Turel (135 million tons). —(*Bd. of Trade J., Mar.* 27, 1919.)

Potash Production in Chile.—In La Huayaca, in the Chanchones district, a factory has been built at a cost of $300,000, and over a ton of potash is being produced daily. The product is of very good quality, and is carefully packed in sacks for export. The cost of production is very moderate, as the factory is built practically on the pampas, where the potash lies at the earth's surface. In Tarapacá a small factory has been established, which is also giving good results.—(*Mercurio, Jan.* 13, 1919.)

Quicksilver in 1916.—The increased demand for mercury due to the war, and the failure to discover new ore bodies, caused heavy depletion of the reserves in the United States and inroads to be made upon the richer deposits. The profits also have not equalled expectations owing to the increased working costs. The use of mercury for antifouling paint for ships' bottoms has extended, and projected new uses, such as the conservation of heat in the generation of steam, give promise of development.

The United States produced 249,732 short tons of ore and other furnace material in 1916, against 158,817 tons in 1915. The total output of metal was 29,932 flasks (of 75 lb.) in 1916, the 1914 production being 16,548 flasks; it is hoped to maintain an output of 30,000 to 35,000 flasks until 1920. The other large producing companies are Austria, which probably produced about 25,000 flasks, Italy 32,129 flasks, and Spain 23,367 flasks, the world's total output for 1916 being estimated at 118,028 flasks. From 1908 to 1916 the American output has increased about 50 per cent. The recovery on 158,817 tons of ore treated in 1915 was 0·497 per cent. of metal, and on 249,732 tons treated in 1916 a yield of 0·45 per cent. was obtained, which is decidedly lower than the 1914 figure of 0·505 per cent. of metal, the quality of ore treated having obviously deteriorated.

The chief producing centre of the United States is California, which affords about two-thirds of the country's total yield, Arizona, Nevada and Texas being responsible for the rest. The value was no less than $3,768,139 in 1916, the price having risen from about $40 per flask in 1913 to $126 in 1916; allowance, however, must be made for the 10 per cent. import tax which is included in the latter figure.

It is stated that the Scott furnaces have been used with conspicuous success. These have capacities of from ten to fifty tons, and effect an almost quantitative yield; in one observed case the loss was less than 1 per cent. of the mercury content of the ore.—(*U.S. Geol. Surv., Feb.* 19, 1919.)

Wolfram Ore Deposits in Siberia.—Wolfram ore deposits were discovered in 1911-12 in the Nertchinsk mining district, Province of Transbaikalia,

Asiatic Russia, but have only been worked to a limited extent. They have been examined recently by Prof. Soutschinsky, of the Imperial Academy of Science, who found principally wolfram in quartz veins, running through granite rocks. The deposits in the Bakuka Mountain contain veins of ore averaging 6—7 in. in cross section, from which about 200 lb. per month was extracted in 1915. The deposits at Tchara-Nor, also on the Trans-baikal Railway, are of a poorer quality containing an undesirably high percentage of manganese. An analysis gave WO_3 76·02%, FeO 9·82%, and MnO 12·95%. Large quantities of scheelite, containing much manganese, have also been found at Tchara-Nor. It is estimated that 20,000 lb. of ore, with 68 to 72 per cent. pure wolframite, has been extracted from mines in the Borzia district. The future of these mines is considered to be promising, as not only are they near the railroad, but other minerals have also been discovered, including considerable quantities of molybdenum glance, yellow molybdenum ochre, and arsenical pyrites.—(*U.S. Com. Rep., Jan.* 23, 1919.)

Extraction of Bromine and Potash in Tunisia.—On the outbreak of war France sought to purchase bromine and bromides from America, but owing to high prices and insufficient supplies the attempt was unsuccessful. Increasing scarcity rendered the position serious, and in April, 1915, when bromine compounds were required for use as lethal gases, the salt marshes or lagoons of Tunisia were investigated, and found to be capable of furnishing a plentiful supply of bromide. In December, 1915, Sebkha el Melah, near Zarzis and one kilom. from the sea, was selected as a suitable site for operations. At this place there occurs a saline deposit covering a thick compact mass of black clay alternating with layers of gypsum mixed with sea salt, the whole being impregnated with a concentrated solution of sp. gr. 1·238 (at 21° C.), which contains, *inter alia*, 13 grm. per litre of potassium chloride and 2·24 grm. per litre of magnesium bromide. The situation rendered transport difficult, but wells were sunk, a railway laid, and works erected at El Hanèche, with six Kubierschky apparatus and other necessary equipment. This locality was able to supply all the bromine required in 1916 and 1917. Each apparatus treats 100 cu. m. of liquid per day and produces 160 kilo. of bromine from a solution of 27·3° Bé, 350—370 kilo. from a solution of 31—32° Bé, and 520 kilo. from liquor of 34° Bé. Very much lower yields are obtained from sea-water, of which only 80 cu.m. can be treated daily. From May 1 to December 25, 1916, the El Hanèche works produced 1050 metric tons of bromine. The chlorine necessary for the process is supplied from France. During the latter half of 1918, a new bromine works was started at Aïn es Serab, and the two works together are expected to produce 80 tons of bromine per month for the first few months of 1919, and afterwards, by treating liquor of higher concentration, 120—130 tons per month.

At Mégrine a process, proposed by Prof. Urbain, was adopted of precipitating potassium, free from sodium, as fluosilicate, by the action of fluosilicic acid on the mother liquor from bromine distillation. The fluosilicate is treated with milk of lime, the resulting solution of caustic potash concentrated in a Kestner evaporator and then over an open fire. The fluosilicic acid was at first specially prepared at Mégrine, but afterwards obtained as a by-product from the superphosphate works at El Afrane. High working costs and foreign competition stopped the manufacture after several tons of potash had been produced.

At the salt marshes of Sfax, the Lambert Rivière Co. has installed a plant for treating the mother liquors on the Merle system. The natural salts found there include a substance called sebkaïnite which contains:—KCl 19·5%, NaCl 10·0%, $MgCl_2$ 27·2%, $MgSO_4$ 9·3%, water and insoluble matter 34·0%. After removal of the potassium chloride, bromine is extracted from the mother liquor. The recovery of potassium chloride from this mineral was started in March, 1917, and, up to the end of January, 1919, the following quantities (metric tons) were produced at El Hanèche:—70% KCl, 700; 35—40% KCl, 1400; 90—95% KCl, 50. In 1918 the Tunisian government decided to erect a works capable of producing 4500 tons of pure potash salts near a marsh of 200 hectares area at Aïn es Serab. Electric power stations have been erected, but owing to delay in delivery of goods, the installation is not yet in operation, but is expected to be ready this spring. The plant will deal with at least 50,000 tons of sebkaïnite.

It is anticipated that, eventually, the Tunisian deposits will rival those of America and Germany. —(*Bull. Soc. d'Encourag., Jan.—Feb.*, 1919.)

OBITUARY.

SIR WILLIAM CROOKES, O.M., F.R.S.

We record with deep regret the loss of one of our most famous men of science, and a former President of the Society of Chemical Industry, in the passing of Sir William Crookes on April 4 last. Born on June 17, 1832, he had reached his eighty-seventh year and during that long life had enriched science by many important discoveries, largely in consequence of his singularly acute powers of observation, his marvellous experimental skill and his philosophical insight. His fine researches in chemistry and physics led Sir William into various fields of inquiry but chiefly those lying within the borderland of those two branches of science, while his alert mind was always open to the consideration of practical and economic problems. The short sketch which follows of so long and full a life is necessarily inadequate to do more than indicate a few of the achievements of so successful a scientific career.

Without entering into details of his early life we may say that Crookes passed from school about his seventeenth year, and without any further academic training, to his scientific studies at the Royal College of Chemistry, under Prof. A. W. Hofmann, and there laid the foundation for his scientific lifework with that inspiring teacher. During the early "fifties" Crookes was an assistant to Hofmann, and later, we find him lecturing on chemistry at the Training College in Chester. After this short teaching experience, he returned to London and founded the *Chemical News* which he edited nearly to the end of his life. Crookes reported for this periodical Faraday's charming Christmas lectures at the Royal Institution on "The Chemical History of a Candle," and thus came under the influence of that great master of experimental science, for whose methods he often expressed to the writer his profound admiration.

A little before that period the scientific world had been roused to enthusiasm by the researches of Bunsen and Kirchoff on spectrum analysis, and the discovery of two new elements, cæsium and rubidium, by the aid of that new and powerful means of research. Crookes early became an ardent student of the method and soon proved its value by the use of it in the discovery of another new element—thallium. The discovery of this element, while a triumph for the young chemist, also led him by a curious sequence of events to researches in a new and unexpected direction, as will presently appear. Before entering on that subject, however, we must refer to a purely chemical piece of work on selenium compounds. Berzelius, who discovered

selenium in 1817, traced points of chemical resemblance between that element and sulphur through its capacity for the production of analogous compounds, and succeeded in forming selenocyanides similar to the sulphocyanides; but he was content with the proof of the existence of the first named salts. Crookes saw that the selenocyanides required further examination, and, having a considerable quantity at hand of the crude seleniferous deposit from the sulphuric acid chambers of the Tilkerode works in the Hartz district, he set about the preparation of pure selenium from this material with which he produced a number of selenocyanides and investigated them in detail. During the purification of the selenium several by-products were obtained, and certain of them when examined by the new spectroscopic method gave the beautiful bright green line afterwards proved to be characteristic of thallium, and so named because the colour of the line suggested that of the young green shoots or twigs of early spring. This somewhat lead-like metal of high density (11·9) has a high atomic weight of 204, which Crookes determined with great accuracy, making his weighings on a balance which was enclosed in a case from which air could be exhausted to a great extent in order to diminish errors from unequal air displacements. When weighings were made *in vacuo* and in full daylight, irregularities in the action of the balance became evident to the keen observer for which he could not account. These observations were followed up when the thallium work had been completed, and it was found that light objects which were free to move in high vacua could be made to do so by mere exposure to light as in the now familiar "Crookes radiometer," the vanes in which are set in rapid motion when a beam of sunlight is allowed to fall on the apparatus. This study of such "repulsion resulting from radiation" was pursued by Crookes with extraordinary skill and ingenuity in devising experiments in various directions, and thus he opened up a new and wonderful field for research in molecular physics.

Crookes had a strong vein of mysticism in his character and a leaning towards the occult, as we know from his own writings, and he was at first rather disposed to regard the phenomena he was investigating as being due to a new and mysterious force; but this quickly gave way to the idea that the radiometer is a "light mill" in which there is a direct conversion of light into motion. This was in turn dissipated when G. Johnstone Stoney pointed out that the motion of the vanes in the radiometer was probably due to their bombardment by the residual molecules of the highly rarefied air in the bulb being projected from the relatively warm sides against the movable vanes. Crookes devised many beautiful experiments in order to test this theory of molecular bombardment and satisfied himself as to its essential validity. He was led on to the study of kathode rays and the bombardment with them of various forms of solid matter which became phosphorescent under their impact. The character of the light emitted under these conditions, when examined spectroscopically, showed bright lines which Crookes regarded as characteristic of the material. He considered the exciting agent to be "radiant matter" in these cases, and the method as "radiant matter spectroscopy" on which investigations he expended much time and labour. It so happened that Crookes had undertaken the separation of the rare earths of gadolinite and samarskite and used his new method, which he regarded as affording characteristic tests for the recognition of and as aiding in the separation of certain of those rare earths. There are doubts as to the value of this mode of identifying the substances, and also as to the existence of "radiant matter," but the phenomena observed materially assisted in the separations carried out by Crookes, and the extraordinary phenomena provided by radium and its "emanation" have disarmed criticism of the term "radiant matter." Needless to say Crookes was deeply interested in the modern work on radioactivity, and contributed many observations of interest, in addition to the production of the "spinthariscope" in which a screen of natural zinc sulphide is made to scintillate by the *alpha* particles projected from radium. He further studied the action of radium emanation on glasses, various gems and diamonds, and often exhibited a fine diamond which was originally colourless but had taken on a greenish-blue tint after retention for some time in contact with radium salts.

While Crookes' fame rests chiefly on the discovery of thallium and his long continued and brilliant researches in the chemico-physical directions above outlined, he took much interest at various times throughout his life in other subjects, including his well-known spiritualistic studies—which we but mention here—and his speculations on "The Genesis of the Elements." The latter was the chief topic of his address to the Chemical Section of the British Association in the autumn of 1886 at Birmingham. The present writer well remembers a day in the early summer of that year when his laboratory in the University was honoured by a visit from the President of Section B, whose keen eye noticed a diagram which was used as a pictorial illustration for lectures on the Periodic Law. He immediately caught the idea, saying "It is the very thing I wanted," and used it in modified form, and with generous acknowledgment, in his presidential address. He further expanded his speculations as to the origin of the elements from what he termed "protyle," when President of the Chemical Society some two years later. Again, Crookes took an active part in the examination of the double spectra of argon shortly after the discovery of the first of the inert elements by Lord Rayleigh in collaboration with Ramsay in 1894, and later on of helium.

Many other illustrations might be given of Sir William Crookes' varied activities in pure and applied science, but probably the most remarkable was his unexpected *excursus* into economics in his address on the "Wheat Problem" when President of the British Association at Bristol in 1898. Of this address he said later, with dry humour, that "he had afterwards to write a book in order to explain it."

In addition we can but mention such subjects as water purification and examination, sewage treatment, electric tanning, dyeing, disinfection in cattle plague, and, latest of all, the production of eye-preserving glasses for spectacles, and further to point out that he translated a number of foreign technical works of varied value, and compiled his well-known and useful "Select Methods of Chemical Analysis."

From 1861, when he discovered thallium, Crookes was the recipient of many honours. Elected a Fellow of the Royal Society in 1863, he presented to that body most of his scientific memoirs; he was three times selected as Bakerian Lecturer, and was the recipient of the Copley, Royal and Davy Medals: he became Foreign Secretary in 1908 and President in 1913. In 1912 he was awarded the Medal of the Society of Chemical Industry. Honorary science degrees from Cambridge, Oxford, and several other universities were conferred upon him; while he became President of several home societies, and many foreign academies and societies gladly enrolled his name amongst their specially honoured members. He was knighted in 1897 and received the Order of Merit in 1910.

Sir William Crookes married Miss Ellen Humphrey in 1856, and they commemorated their golden wedding in 1906. Lady Crookes predeceased Sir William in 1916.

J. Emerson Reynolds.

LEGAL INTELLIGENCE.

SOAP CONTRACTS DISPUTE. *Van den Hurk v. Is. Poliakoff and Co., and Is. Poliakoff and Co. v. King and Ramsay.*

In the King's Bench Division on March 31 before Mr. Justice Lush, Messrs. Van den Hurk claimed to recover from Is. Poliakoff and Co. the difference between the market price and the real value of 25 tons of white soap, sold by defendants to plaintiffs, and which was warranted to contain 63 per cent. of fatty acids. Messrs. Poliakoff and Co. in turn claimed against Messrs. King and Ramsay who were the sellers to them.

Mr. E. J. Dobbs, analytical and consulting chemist, gave evidence that a sample submitted to him was found to contain: fatty acids, 12·95%, water and glycerin 72·92%, and silica, as sodium silicate, 6·84%. Counsel for King and Ramsay denied warranty.

Mr. Justice Lush based his findings upon the results of the analysis, and gave judgment for the plaintiffs in both actions. The following day the parties agreed that judgment would be satisfied by the payment of £625 and costs in the first action, and of £560 and costs in the second. His Lordship fixed the damages at £760 and £720, respectively, in the event of the agreed terms not being carried out.

SALICYLIC ACID PLANT. *Lennox Foundry Co. v. Warrington Drug and Chemical Co., Ltd.*

This case came before the Court of Appeal on April 11, on the appeal of the defendants from a judgment of a Divisional Court in favour of the plaintiffs, and reversing a judgment of the Official Referee (this J., 1918, 156 R, 477 R). Lord Justice Bankes, delivering the judgment of the Court, said he agreed with the Official Referee that the plant as a whole was not of the contract capacity. The respondents were entitled to be paid the instalment due on delivery, viz., £220, and the appellants were entitled to £440 damages. Judgment would be entered for the appellants on the claim and counterclaim. The respondents would have the costs of the appeal to the Divisional Court, and the appellants the costs of the present appeal.

PARLIAMENTARY NEWS.

HOUSE OF COMMONS.

Sheffield Water Supply.

The Sheffield Corporation Bill, under consideration by the Local Legislation Committee, includes a novel scheme for conserving the water in the River Don, which is the main source of supply of Sheffield, and which is now found to be quite inadequate owing to the large quantities required for local industries. The proposal involves pumping water from the river below the town, treatment and purification, then, after utilisation for industrial purposes, re-treatment and restoration to the river. There is considerable opposition to the Bill.—(April 8.)

British Cellulose and Chemical Manufacturing Co.

The Chancellor of the Exchequer, in reply to Lt.-Col. Malone, stated he was aware that the above company was about to increase its capital by approximately £1,250,000 in preference shares; and that no licence to increase the capital was necessary as permission was granted prior to the promulgation of the Regulation involved. After careful deliberation it was considered inadvisable to suspend the issue pending the publication of the report of the special committee investigating the company's affairs.—(April 10, 14.)

The Royal Society of Edinburgh.

Mr. W. Graham asked if the Chancellor of the Exchequer would reconsider his refusal to increase the grant of £600 given annually to this Society for the publication of scientific researches, in view of the greatly increased costs of publishing. Mr. Chamberlain regretted that he could not do so at the present time.—(April 14.)

Scottish Oil Industry.

Mr. Kidd asked the Prime Minister for an assurance that the Scottish oil industry shall not suffer destruction owing to increased costs consequent on the recommendation of Mr. Justice Sankey's Commission, and that any injury will be avoided, if need be, by the imposition of a tariff operating against foreign products competing with those of this industry. Mr. Bonar Law replied that the whole question of the Scottish shale industry is receiving careful consideration, and no statement could be made at present.—(April 14.)

German Pre-War Mineral Output.

In a written answer to a question of Sir N. Griffiths, Mr. Bridgeman, for the Board of Trade, gave the following statistics of the production in Germany of coal, potash and metallic ores during 1912 (unless otherwise stated):—

	Production Metric tons	Approximate value at the mine £
Coal (1913):—		
Bituminous	191,511,000	105,793,000
Lignite	87,233,000	9,436,000
Potash, from mines:—		
Kainite	5,889,238	3,819,100
Carnallite (including kieserite)	5,271,964	2,162,650
Potash, from wells, etc.:—		
Potassium sulphate ...	123,407	1,018,650
Potassium and magnesium sulphate	54,435	221,200
Potassium chloride ...	506,744	3,434,200
Metallic ores:—		
Cobalt, nickel, bismuth, tin ores and bauxite	47,526	36,700
Uranium and tungsten ores	5,053	3,200
Iron ore	27,200,000	5,506,650
Lead ore (argentiferous)	107,563	962,450
Manganese ore	92,474	58,400
Pyrites	262,653	101,900
Copper ore...	974,285	1,596,800
Zinc-blende	516,358	2,490,500
Zinc-calamine	120,950	106,700

—(April 14.

GOVERNMENT ORDERS AND NOTICES.

PROHIBITED EXPORTS.

The following relaxations of existing prohibitions are announced by the Board of Trade:—

Headings transferred from one list to another.

From List A to List B:—

Milk, condensed or preserved; milk, powder; tomato pulp.—(April 10.)

From List A to List C:—

Albumin, other than blood albumin; egg powder (dried eggs); levulose; sheepskins, haired or woolled.—(April 10.)

Asphalt; asphalt, coal tar; bitumen; wire, silk covered; vinegar essence and similar preparations containing more than 6 per cent. acetic acid.—(April 17.)

From List B to List C:—

Camphor; vinegar containing not more than 6 per cent. acetic acid.—(April 10.)

Altered Headings.

(a) Cotton, American; (c) Cotton, raw, other than American.—(April 10.)

An open general licence has been issued permitting the following foodstuffs to be exported to all destinations except those referred to in List C:—Egg yolk, dried; egg products, dried; liquid eggs, preserved, not including frozen eggs; beans, imported, other than soya, locust or Chinese horse beans.

PROHIBITED IMPORTS.

General licences have been issued for importation of the following goods:—Leather scrap and fillet; gold ores, auriferous; copper ores, and sweepings and residues containing gold; articles made of or containing gold when produced in and exported from any part of H.M.'s Dominions; cocoa powder; and various alcoholic beverages.

Resumption of Trade with certain Countries.—German Austria.—A general licence was issued by the Board of Trade on April 3 authorising the resumption of trade with German Austria, subject to licences being obtained where prescribed. "German Austria" includes Upper Austria, Lower Austria, Salzburg, Styria, Carinthia, Tyrol (northern or Innsbrück portion), Vorarlberg and Liechtenstein.

Poland.—Trade with Poland is also subject to licences issued by the War Trade Department in respect of all goods except those on the "free" list. Goods must be consigned to the Inter-Allied Relief Administration, Dantzig.

Jugo-Slavia, Montenegro, Albania.—H.M. Government has decided that, with a few exceptions, all goods not included in Lists A and B may now be exported to these countries without licence.

Lettland and Lithuania.—Trade relations with these territories may be resumed forthwith.

The Board of Trade has notified that it has taken over the War Trade Department, which will be known henceforth as the Export Licence Department.

The Minister of Munitions has announced that the control of nitrate of soda will be suspended on and from May 15 next. Until that date the issue of general licences will be continued.

NEW ORDERS.

The Coal Tar and Coke Oven Returns (Suspension) Order, 1919. Ministry of Munitions, April 4.

The Pitwood Order, 1919. Board of Trade, April 14.

The Copper Sulphate (Suspension) Order, 1919. Ministry of Munitions, April 15.

The Blast-Furnace Dust (Suspension) Order, 1919. Ministry of Munitions, April 15.

NOTICES.

On March 31, the Army Council issued a Notice cancelling thirty Orders relating to Raw Wool (including Fleece and Skin Wool and Off-Sorts) and Sheepskins. The schedule of Orders so cancelled appeared in the *London Gazette* of April 8.

The Army Council has also cancelled the Jute (Control) Notice, 1917.

The Food Controller has revoked the Milk Products (Import Restriction) Order, 1918, the Milk Products (Returns) Order, 1918, the Wholesale Milk Dealers (Control) Order, 1918, and the Milk Requisition Order, 1917.

OFFICIAL TRADE INTELLIGENCE.

(From the Board of Trade Journal for April 10 and 17.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 73, Basinghall Street, London, E.C. 2, from firms, agents or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

Locality of Firm or Agent	Materials	Reference Number
Australia ..	Chemicals and edible oils	110/4/7*
British India ..	Chemicals, steel and metals, matches, cement, paint, soap, glass	600
,, ..	Explosives, paints, varnishes, lubricating oils, cement, calcium carbide	656
,, ..	Photographic chemicals	655
,, ..	Chemicals and gold thread	662
,, ..	Iron, steel and other metals	663
Canada	Dyes and parchment paper	604
,, ...	Pottery, china and glass	6)2, 6 7
,, ...	Chemicals for the paint, varnish and soap trades	678
,, ...	Glass and china	†
,, ...	Chemicals, drugs, laboratory equipment ..	†
British West Indies ..	Paints	‡
Austria (Trieste)	Copper sulphate	608
Belgium ..	Nitrate of soda and fertilisers	611
,, ..	Chemicals, iron ore, ferro-silicon and manganese	687
,, ..	Benzine, turpentine, white lead, colours, glue, soap, etc.	698
,, ..	Dyes, cement, rubber, fertilisers, edible fats ..	2369 T and R §
Chile	Chemicals, drugs, iron, aluminium, rubber, paper, china, earthenware	618
France	Tallow, oils, wax, soap, starch	629
,, ...	Iron, steel, tin, etc. ..	705
,, (N. Africa)	Glass, china, porcelain ..	630
Greece	Paints, varnishes, colours	707
Netherlands ..	Chemicals, dyes, oils, greases	634
,, ..	Gums, resins, waxes, glue	636
Norway ..	Chemicals, oils, rubber, paints, soap	713
Scandinavia ..	Chemicals, metals, crucibles, oils, paints ..	639
,, ..	Dyes, colours, oils, resin, alum	640
Spain	Metals, colours, varnishes	641
,, ...	Chemicals and tinplate ..	642
,, ...	Glassware	644
Switzerland ..	Chemicals, drugs, greases	647, 718
United States ..	Ores and metals ..	721

* Official Secretary, Commonwealth of Australia, Commercial Information Bureau, Australia House, Strand, W.C. 2.

† High Commissioner for Canada, 19 Victoria Street, S.W. 1.

‡ The Secretary, Statistical and Information Department, London Chamber of Commerce, 97 Cannon Street, E.C. 4.

§ Belgian Trade and Reconstruction Section, Department of Overseas Trade, India House, Kingsway, W.C. 2.

TARIFF. CUSTOMS. EXCISE.

Belgium.—The prohibition of the import of liquids containing alcohol does not apply to liquids which cannot be used for beverages, *e.g.*, perfumery, pharmaceutical products, and varnish.

French Colonies.—The list of goods the exportation of which from the French Colonies (other

than Tunis and Morocco) is prohibited, except under licence, as from March 29, is the same as the list of goods prohibited to be exported from France by the Decree of January 20.

France and Algeria.—It is proposed to reserve to the State until October 1, 1920, the manufacture of alcohol, except in certain cases.

France (*Morocco*).—The sale of alcoholic beverages, with certain reservations, is now permitted.

Italy.—A surtax of 100 lire per hectolitre is payable on imported pure spirit until July 31, 1919.

Portugal.—The surtax on imported alcohol has been increased by 5 escudos per decalitre.

South Africa.—It is proposed to increase the import duty on spirits.

Spain.—A copy of the new regulations governing the manufacture and sale of pharmaceutical specialities may be seen at the Department of Overseas Trade.

The export duty on lead ores is suspended until May 31 next.

Switzerland.—Several commercial treaties have been denounced.

United States.—A new general import licence, "P.B.F. 34," has been issued to cover the import of all unrestricted goods as from March 6. Among the articles expressly excluded from the terms of this licence are tin, tin ores, tin concentrates and alloys with more than 20 per cent. of tin, peanuts, salvarsan and other similar organic arsenic compounds, nitrate of soda, and sugar.

Lard and neutral lard have been removed from the export conservation list as from March 6, and the import restrictions on spiegeleisen and ferromanganese have been withdrawn as from April 10.

COMPANY NEWS.

THE SALT UNION, LTD.

The thirtieth ordinary general meeting was held at Liverpool on April 3. The accounts for 1918 show a net profit of £338,828 on an issued capital of £2,400,000 (debentures £1,200,000), as compared with £287,380 in 1917. The dividends for the year are maintained at 2s. 4d and 3s. per share on the preference and ordinary shares, respectively. The chairman, Mr. G. H. Cox, referred in his speech to the trade of the past year, to the detrimental effects of Government control, and to the labour position. The leading feature of the salt trade during 1918 had been the shortage of tonnage, certain important markets having been wholly or partially lost owing to this cause and to Government interference. Prices had been maintained at a satisfactory level in the home trade, and such salt as had been shipped abroad realised a highly remunerative price. Since the cessation of hostilities there had been an excellent demand at extreme prices from those countries which had been suffering from a great shortage of salt. The policy pursued since November last of allowing Germany to export salt to Sweden, thereby robbing us of our customers, and of prohibiting shipments from this country, was incomprehensible. The Eastern trade had been disastrously affected by lack of shipping facilities, the total shipments for the year amounting to only 20,000 tons. As regards the current year, trade had so far continued on a profitable basis, but the outlook was very uncertain. More labour was becoming available, but at high rates; raw materials, such as coal and iron, were still scarce and very dear; freights had fallen, but so had prices in the export markets. The prospects for the home trade were, on the whole, not unfavourable.

UNITED ALKALI CO., LTD.

In his address to the annual meeting, held at Liverpool on April 16, Mr. Max Muspratt said that no other company manufactured such a range of vital chemical products, and the fact that many of these were barely remunerative before the war might easily have led to their abandonment. After nearly 100 years of service the Leblanc process had become obsolete owing to the constantly increasing cost of labour and fuel. The company was firmly established in the ammonia soda process; but that does not produce chlorine, and arrangements were made just before the war to make a complete transference from the Leblanc to the electrolytic process. Delay in carrying out this programme proved of incalculable benefit to the country, inasmuch as they were able to place their production of sulphuric acid at the disposal of the explosives factories. The necessary concentration of this acid was executed at the company's works, which had to be greatly enlarged for the purpose. Other services rendered to the explosives industry were the manufacture of picric acid, by a process devised by Prof. Green, and the supply to the Government of the chief ingredient of amatol. Sodium hyposulphite was supplied for the first gas masks used, and the company was instrumental in the production of six lethal gases, four of which were extremely effective. Superphosphate was issued free to the allotment-holders of Liverpool and district, and the cold storage industry was aided by the provision of calcium chloride. The large production of sulphur dyes during the war was rendered possible by the efforts of the United Alkali Company.

The unfavourable aspects of the general outlook are industrial unrest, the serious position of our foreign trade, the readjustment of the production of chemical products to meet the altered needs of peace, and the excess profits duty. On the other hand, many of the extensions of plant, which have cost the company £2,500,000, will be of great value, the recently acquired experience of the staff will be a most useful asset, and the tendency towards co-operation among manufacturers should lead to a mitigation of cut-throat competition. The company has assisted the movement tending to closer co-operation between labour and management. It is too soon to say if the Joint Industrial Council for the Chemical Industry will attain absolute success; collective bargaining has many advantages, but chemical processes are so diverse, and conditions vary so much in different works that automatic rises or reductions in wages for the whole country are liable to produce widely differing results. More autonomy will have to be sought, as a spurious uniformity may have disastrous results. The company employs some 10,000 workers; the wage bill has more than doubled, while payments for interest and dividends, after allowing for taxation, are practically at the pre-war level.

In conclusion Mr. Muspratt pleaded for removal of Government control. The introduction of cost accounting into many of the smaller works was a very valuable reform, but the system adopted had in many respects operated unfairly in the case of the United Alkali Co. After making the fullest allowance for the exigencies of the war, the unnecessary disturbance and interference caused by Government control had cost the country untold millions, and had enormously accentuated the general feeling of unrest and uncertainty. The wholesale scrapping of Government factories was due to the conviction that their manufacturing costs, irrespective of depreciation or management charges, were in almost every case higher than

most manufacturers are prepared to charge to cover all these items and include a profit.

The report was adopted, including the payment of the dividends recommended therein, and the meeting was adjourned to a subsequent date when the accounts and balance sheet could be presented.

RIO TINTO CO., LTD.

At the forty-sixth ordinary general meeting held on April 8, Sir C. W. Fielding, the chairman, said that the termination of hostilities and the stagnation of manufacture had left large stocks of copper to be disposed of. Even assuming a general reduction in output, it would be a long time before demand equalled supply, but owing to the increased cost of production, which to some extent is likely to be permanent, there is little likelihood of a return to the former low prices. The cost of production in America will probably again become the governing factor in regard to profits. There are exceedingly large supplies of pyrites in the United States, and in this country Government intervention has disorganised practically all markets without any regard for the future of producers or consumers. He looked forward to developments of a technical nature to counteract to some extent the lower prices that will be obtained from the sale of ore. The company possesses unlimited raw material; it can produce both copper and sulphur more cheaply than others; and the clean iron extracted from the cinders becomes more and more valuable.

EXPLOSIVES TRADES, LTD.

The statutory general meeting of this company, the important explosives combine (this J., 1918, 462 R), was held in London on April 11. Sir G. J. Smith, deputy-chairman, who presided, said that practical unanimity had been shown by the shareholders of the constituent companies in accepting the proposals for the exchange of their former shares for those of the amalgamated company. Active steps are being taken to give the various manufacturing establishments the benefit of technical co-operation and exchange of ideas; and on the commercial side important missions are being sent to various colonies and other countries to extend and consolidate the company's operations abroad.

SOUTHALL BROS. AND BARCLAY, LTD.

In presiding at the annual meeting of shareholders, held in Birmingham on April 11, Sir Thomas Barclay said that the turnover last year showed an increase of more than 400 per cent. over that of 1913. The profit for the year was £25,764, and it was proposed to pay a dividend of 10 per cent., plus a bonus of 1s. per share, to the ordinary shareholders. The German manufacturers of fine chemicals were making a bid for the business in neutral countries by quoting what were referred to as reduced prices, but these were far in excess of pre-war figures, and were higher than those quoted in this country for similar articles of British manufacture. To secure the permanence of this industry, a scheme like that adopted by the dye industry seemed to have much to commend it, and to be preferable to the imposition of tariffs. By prohibiting imports except under licences granted on the advice of a committee representing both manufacturers and users, dumping would be prevented and the home consumer protected against any artificial raising of prices owing to lack of competition.

REPORTS.

Interim Report of the Water Power Resources Committee. *Board of Trade.* 1919. (Cmd. 79, 2*d.*)

The subject matter of this report deals mainly with suggested methods for utilising the water power resources of Scotland. It has been issued now because if development were taken in hand at once, immediate employment would be found for a large number of workers.

Nine separate schemes are described capable of providing a total of 183,500 continuous electrical horse-power. The cost of development based on pre-war contract prices plus 50 per cent. to allow for increased costs is estimated to be £7,075,000, or an average of £38·5 per e.h.p. at the power house. The estimate includes all civil engineering and hydraulic works, power house and plant, and a reasonable sum for compensation for the rights and property that would have to be acquired. If the work were spread over three years employment would be found for from 7000 to 18,000 men. The 183,500 e.h.p. corresponds to an output at the hydro-electric stations of 1200 million Board of Trade units per annum, which on the basis of the present average practice of coal-fired power stations represents 1,850,000 tons of coal. If all the nine schemes were fully developed and fully utilised it is estimated that the cost of generation of energy would not exceed 0·15 of a penny per unit at the power station. This figure includes all running expenses and capital charges, but would only hold good in the event of the continuous use of practically the whole output of energy at works situated near the power stations. The Committee, however, is of the opinion that electric energy could be transmitted to the industrial districts of Scotland, and delivered at a cost considerably lower than the present charges for current in those districts.

The development of hydro-electric power would provide employment for the local inhabitants and tend to the resettlement of many now sparsely inhabited districts. This in turn would lead to developments in agriculture and railway transport facilities.

There are other districts in Scotland where the development of hydro-electric power could be undertaken, and although the topographical conditions in England are not so good, there are districts available in the Lake District and in Devonshire. In North Wales alone there is one site where 4400 continuous e.h.p. could be developed at an estimated capital cost of £41·8 per effective e.h.p.

The Committee considers that certain fundamental principles must be observed:—(*a*) Each watershed area must be studied as a whole and no partial exploitation should be permitted which might in the future interfere with the most economical advantage being taken of the whole area. (*b*) The interests of domestic and trade water supplies, fisheries, drainage of adjacent land, canals and other inland means of navigation must be properly safeguarded. (*c*) Part of the available power must be reserved for the present or future needs of the local population of the watershed area.

There is need for further records of rainfall and the gauging of the flow of rivers, and provision should be made for this work as well as for facilities at the universities or elsewhere for training hydro-electrical engineers, as at the present these seem to be almost entirely lacking.

REPORT OF THE COMMITTEE OF CHAIRMEN ON ELECTRIC POWER SUPPLY. *Ministry of Reconstruction.* [Cmd. 93, 1*d.*]

The report (dated October 14, 1918) of the Committee of Chairmen of different sections of the Advisory Council to the Ministry of Reconstruction deals with certain administrative aspects of electric power supply. The Chairmen recommend that electrical power should be generated and transmitted throughout the United Kingdom upon a single unified system, organised and conducted upon commercial lines, under State regulation, and with such financial co-operation on the part of the State as may be found necessary in order to secure the speedy development of an effective system of electric supply throughout the United Kingdom.

The question of supplying current at a uniform price for all areas is answered negatively, as it would not be commercially sound to supply current irrespective of the conditions of demand or the circumstances attending supply. The Committee also recommends the appointment of an Electricity Board, consisting of six men of proved business capacity, accustomed to handle large commercial undertakings, and who should receive adequate payment for their services. The first duty of this Board would be to elaborate a comprehensive scheme of supply for the whole country, and then by degrees to apply it in practice, but the technical part of the execution and management should be in the hands of an "Operating Executive" which must conduct its operations on a strictly commercial basis. The actual constitution of this Executive and the financial methods to be adopted should be settled later on by the Board. Full advantage would be taken of existing local agencies, in whose hands the actual distribution of power might well be left, but the general idea is to have a network of inter-connected businesses, co-ordinated as to general policy and financial control by a Central Executive which would be responsible to the Electricity Board. The financial operations of the Board should be under Parliamentary control, and the interests of the public should be safeguarded by regulations issued by the President of the Board of Trade.

Attached to the report is a dissentient minute by Mr. L. Hichens, in which he records his opposition to ownership and management of such undertakings by the State. State management and sound commercial trading are mutually exclusive.

TRADE NOTES.

BRITISH.

Ceylon Graphite Industry.—The production of plumbago has recently declined as the United States has been importing the mineral from Madagascar and has also been stimulating its own production of flake graphite. England, on the other hand, obtained a larger proportion of her requirements from Ceylon than hitherto.

There have been considerable variations in prices. These fluctuated from Rs. 750 to Rs. 350 per ton, compared with Rs. 1350 to Rs. 600 in 1917. The price of "chip" stood between Rs. 500 to Rs. 175, as compared with Rs. 900 to Rs. 400. "Dust" ruled from Rs. 275 to Rs. 80, as compared with Rs. 400 to Rs. 150. This price will probably never be reached again, owing to competition from Madagascar. (*Cf.* this J., 1918, 396 R).

Trinidad and Tobago in 1917.—The imports of these islands during 1917 were valued at £4,789,719 and the exports at £5,308,996. The former included the following items, the figures in brackets indicating the proportion of the total provided by the United Kingdom:—Cattle and other animal foods, £43,974 (0·5%); cement, £48,748 (49·5%); calcium carbide, £3090 (0·3%); glass and glassware, £17,643 (17·6%); painters' colours and materials, £19,275 (59·5%); soap, £53,234 (89%); and starch £2665 (1%). The exports included the following (those to the United Kingdom being indicated as above):—Asphalt, 109,880 tons (7·3%); bitters, 22,667 galls. (48%); coconuts, 16,595,282 nuts (12%); copra, 7,201,448 lb. (61·5%); cocoa, 70,144,898 lb. (10%); molasses, 1,398,324 galls. (50%); rum, 87,192 galls. (85%); petroleum, 37,139,608 galls. (79%).

The cocoa crop was a record one, the United States taking 38,766,427 lb., the United Kingdom 7,074,205 lb., and France 21,549,580 lb. Sugar experienced a year of good prices and good crops, 62,654 tons being produced as against 57,755 tons in 1916. The coconut industry, which suffered severely during the drought of previous years, has quite recovered.

At the end of 1917, there were eleven companies drilling for oil in Trinidad. Out of 44 new wells sunk, oil was struck in 31. The total output of oil was 56,080,914 Imperial gallons, as against 32,475,695 galls. in 1916. Several refineries are engaged in the manufacture of petrol, and kerosene is manufactured for local use. Two large refineries are now in operation producing oil fuel to Admiralty specification.—(*Colonial Reports—Annual*, No. 984, *Feb.*, 1919.)

GENERAL.

The Nitrate Situation in Chile.—At the end of January the nitrate market in Chile was lifeless. Huge stocks were in existence at Antofagasta, Iquiqé and Mejillones; 21 oficinas in Tarapaca and 8 in Antofagasta had closed down or were running part time. The labour situation was acute, but the Government was handling it most intelligently. An offer was made by the Government to purchase the 1919 nitrate production at 13*s.* 2*d.* per quintal, but there are various obstacles to such a scheme, notably inability to store. The market views the situation hopefully, and expects a normal demand to return in 5 or 6 months.—(*U.S. Com. Rep., March* 19, 1919.)

The General Nitrate Position.—The announcement that the Nitrate Executive has been wound up may be regarded as a probable indication that this product will at an early date be removed from the prohibition list. During the past few months the trade has been passing through a crisis owing to the cessation of purchases by the Allied Governments, which were left with large stocks on their hands in Chile, in America, and in this country. Notwithstanding the blockade of Germany and rationing of neutrals, it is understood that the stocks both here and in America have now been absorbed. On the Continent the demand has been very active, despite the fact that the price charged by the Allied Governments has been £25 to £28 per ton. Chilean stocks have, owing to the restriction on shipping, gradually increased, and, as compared with a normal stock of 600,000 tons, they now stand at 1,150,000 tons, of which probably 150,000 tons remains in the hands of the Allied Governments. This total is, however, not so formidable as might appear, for immediately the market becomes free it is estimated that at least 500,000 tons will be immediately required by the countries which have been totally depleted during the war. Owing to the impossibility of shipping at present, many oficinas have closed down, and the production has fallen from 250,000 to 150,000 tons per month. This state is likely to continue till the end of June, but after that date it may be expected that most of the oficinas now closed, which are reasonably cheap producers, will reopen, and forward sales

on a large extent are to be expected as soon as the Government restrictions are removed. The position for 1919, of course, underwent a complete change on the signing of the Armistice, and owing to the fact that most companies will only produce to half their capacity this year profits will be curtailed accordingly. On the other hand, all the synthetic nitrate works in Germany are reported to have closed down, and that country may therefore be expected to become a large buyer of Chilean nitrate for next spring, which requirement, together with an increasing demand in all other countries, is likely to absorb the available supplies. While, therefore, large profits for this year may not be obtained, the future outlook for the industry looks promising.—(*Fin. Times, April* 9, 1919.)

The Zinc Market in 1918.—In the annual review of the spelter market, issued by Messrs. Rudolf Wolff and Co., it is stated that the average official price of spelter during 1918 was £52 4*s.* per ton. Up to November 25 last, the official prices were £54 to £50 per ton, but, it is stated, these were fictitious, as consumers were asked to pay £57 per ton for ordinary quality, delivered at consumers' works, and £75 per ton for 99·9 per cent. guaranteed metal. According to the United States Geological Survey the production in that country in 1918 was 537,500 (short) tons, as compared with 695,735 tons in 1917. Japan produced about 43,800 tons in 1918, as against 42,000 tons in 1917. The Canadian production is estimated at 12,500 tons (14,000 tons in 1917), the British 33,000 tons, which is rather less than in 1917, the Australian 5892 tons, and the French from 10,000 to 20,000 tons. The above figures, which are not final, show a general tendency towards diminished production. The position in the United States is unique. When prices rose to over £100 per ton, many new works were started and paid for out of the huge profits made by the older works. As the price of production was taken at about £60 per ton, the owners of these new works closed them down directly the price fell below this figure. The value of spelter in that country is now about 6 cents per lb. (say £27 per short ton) and it appears probable that production will be further drastically curtailed.

As regards consumption in this country, the output of galvanised iron has been stifled, and there are arrears of about 2¼ million tons, based on pre-war figures, to supply. This quantity is equivalent to about 200,000 tons of spelter—a normal year's output in the United Kingdom. There has been some disappointment about supplies of zinciferous materials, and our capacity for treating Australian concentrates is below what was expected.

German Zinc Statistics.—A recent issue of the *Deutsche Allgemeine Zeitung* gives the following approximate figures for the output and trade in zinc during 1918 (metric tons):—Production, 280,000; imported, 56,000; exported, 105,000; consumption, 231,000. A considerable proportion of the last-mentioned quantity was sent abroad in the shape of semi-manufactured and finished goods. In 1913, Germany smelted 260,000 tons of foreign zinc ores yielding 103,000 tons of zinc, and 541,000 tons of home ores yielding 175,000 tons of metal. The crude zinc output of the War Raw Material Section was 196,500 tons in 1916, 186,500 tons in 1917, and 198,000 tons in 1918 (up to October). These amounts fully covered war needs. At present the home zinc production exceeds the demand, and although the latter will increase after the signing of peace, there will be no necessity for some time to come to import either zinc ores or the finished material.—(*Bd. of Trade J., April* 3, 1919.)

REVIEWS.

The Manufacture of Aluminium. *By* J. T. Pattison. *Pp.* 104. (*London: E. and F. Spon, Ltd. New York: Spon and Chamberlain.* 1919.) *Price 7s. 9d. net.*

This is a very small book on a very large subject. Two-thirds of Mr. Pattison's space is devoted to the analytical methods used to control the processes by which aluminium is produced, the remaining 41 pages being divided into chapters describing the manufacture of electrodes and alumina, the history, occurrence and founding of aluminium; its alloys, uses and application.

In the analytical section the author is clearly most at home. The methods he describes are on the whole workable, though recent developments are excluded, while much space is devoted to sampling, standardisation of solutions, gas and coal analysis and descriptions of every-day apparatus. Curiously, in view of the title, no chapter deals with the actual electrolysis, although in the historical section several pages are devoted to showing how the electrical efficiency of the process may be calculated without, however, arriving at any result. The occurrence of aluminium is interestingly discussed, while the chapters dealing with the manufacture of electrodes and alumina, although not generally representative, give an adequate outline of their subjects as applied to one factory. The remaining three chapters must be regarded as totally inadequate.

The book contains some very surprising statements. Few soldiers will share the author's view that "aluminium would make splendid field guns," or metallurgists back his statement that "in most alloys of aluminium an intra-physical (*sic*) change takes place," or that the Schoop welding process depends for its success upon first plating the metal with copper. Nor does "amethyst" appear to be a promising source of aluminium. There is a table of physical and mechanical properties from which the reader may gather, *inter alia*, that "the tensile strength of aluminium is about 17 tons per sq. in.," while "the breaking load in lb. per square inch section=28,200." Richard Seligman.

Organic Chemistry for Advanced Students. *By* Julius B. Cohen. *In 3 Parts. Second Edition. Part I. Pp. viii + 366; Part II. Pp. vii + 435; Part III. Pp. vii + 378.* (*London: Edward Arnold,* 1918.) *Price 54s. net.*

Whilst the plan and subject-matter of the more elementary text-books on organic chemistry present no great difficulties, the preparation of a handbook for those who have penetrated what Wöhler described as "the tropical forest primæval, full of the strangest growths," is a task requiring sound judgment and a first-hand knowledge of the requirements and aptitudes of advanced students. The objective may be approached either by a systematic extension of the fundamental data and principles following the sequence of the ordinary text-book, as in Victor Meyer's admirable "Lehrbuch der Organischen Chemie," or the systematic order may be abandoned in favour of summary accounts of selected portions of the subject-matter. There are complementary advantages in the two methods. The latter, which is that adopted by Prof. Cohen in the work under review, is in many respects the more stimulating as it brings the data and theoretical considerations drawn from a wide range of compounds under a common head, and thus permits of their discussion from a more general standpoint than would otherwise be possible. The reader is thus encouraged to build up and reconstruct his knowledge from within as well as from without, and provided the

reading is accompanied by careful thought, the result should prove in every way advantageous. This spirit of inquiry and introspection is fundamental for the application of the knowledge gained.

The new edition of Prof. Cohen's book is published in three parts, in place of the two volumes of the earlier issue, with the object of securing a more effective grouping of allied subjects and of linking them together, as far as possible, in a consecutive form. The three parts are entitled "Reactions," "Structure," and "Synthesis"; each part is provided with a separate index both of subjects and of authors.

Part I. commences with a concise historical introduction in which the rise and development of organic chemistry is sketched, and is followed by chapters on the Valency of Carbon, Nature of Organic Reactions, Dynamics of Organic Reactions, and Abnormal Reactions. In the first of these the tervalency of carbon as shown in the triphenylmethyl group and the evidence in favour of bivalent carbon in many cyanogen and allied compounds, together with modern theories of valency, are fully and fairly discussed, and although the space allotted to the subject might be regarded as somewhat too great, it is fully justified in view of the important part the element carbon has played in the development of both the earlier and modern views on valency. The subject serves as a good introduction to the succeeding chapter on the Nature of Organic Reactions in which additive reactions, conjugated double bonds, Thiele's theory and allied problems are first discussed. The concluding portion which deals with condensation reactions concerned with chain and ring formation is, however, unnecessarily long and detailed. It extends over 100 pages, and although most carefully dealt with, the examples selected are so numerous that they are likely to prove wearisome reading. Apart from the advanced student whose thoughts are too fully centred on the examination room, a more restricted choice should suffice to inculcate the main principles involved, and would give a happier stimulus to further inquiry for which references should suffice. The chapter on the Dynamics of Organic Reactions comprises a useful and well-selected choice of the applications of physical chemistry to organic problems. Reactions associated with steric hindrance form the subject-matter of the concluding chapter on Abnormal Reactions.

Part II., the volume on "Structure," deals entirely with theoretical considerations, and comprises Physical Properties in relation to Structure, Stereo-isomerism, Isomeric Change, and a full discussion of the elusive, time-honoured problem, the Benzene Theory. Each of these important subjects is described with exceptional clearness and lucidity; they are brought thoroughly up to date, and no bias towards any one view is apparent. This unbiassed attitude has its merits, but it would perhaps be more suggestive and stimulating to readers had the author drawn upon his store of ripe experience and knowledge to indulge in a somewhat fuller criticism of the subjects concerned; it would have added interest, for instance, to learn his views on asymmetric synthesis in relation to vitalism. The problems are, in the main, developed historically. Although this method of presentation has value, the present day view-point is enhanced, in many instances, by a less heuristic treatment; for example, the subject of tautomerism when developed from Lowry's theory of reversible isomeric change or dynamic isomerism gives excellent opportunity for placing all the phenomena concerned on a comprehensive and applicable basis.

The concluding volume, "Synthesis," gives a comprehensive and accurate account of the synthetical methods employed in the preparation and study of the Carbohydrates, the Purine Group, Terpenes and Camphors and the Alkaloids, together with a chapter on Fermentation and Enzyme Action. The subject-matter selected is no doubt representative and instructive, and with obvious limits of space much material must necessarily be excluded. There are, however, other subjects which might perhaps do more than some of these classical examples to arouse the interest of students towards research, such as the natural synthesis of vital products, and the services of modern organic chemistry to allied sciences such as pharmaco-therapeutics; nor would it appear out of place were some of the modern developments of industrial organic chemistry outlined as a stimulus to the association of academic work with industrial progress, or some account included of the practical methods of organic chemistry and their limitations. Perhaps some of these suggestions or similar material may be incorporated in a future edition.

These few criticisms, however, stand apart from the outstanding value of the work as a whole which is written with the very greatest care and authority. This new edition will continue the good work of the previous issue in aiding the study of organic chemistry, and the author is to be congratulated on the admirable manner in which he has carried out his task and on the timely publication of the work. Every stimulus to the study of organic chemistry is more than welcome to-day; the country has an opportunity of redeeming the neglect of the past by the retention and development of the organic chemical industries. Their future is dependent on those whose knowledge of organic chemistry leads them from studentship to research, for in no branch of the science can it be more truly said that "pure scientific research, carried out in the laboratory, is the soul of industrial prosperity."

CHARLES A. KEANE.

PUBLICATIONS RECEIVED.

THE SPINNING AND TWISTING OF LONG VEGETABLE FIBRES (FLAX, HEMP, JUTE, TOW, AND RAMIE). *By* H. R. CARTER. *Second Edition, Revised and Enlarged. Pp.* 434. *(London: C. Griffin and Co.* 1919.) *Price 24s.*

THE PRINCIPLES OF BLEACHING AND FINISHING OF COTTON. *By* S. R. TROTMAN *and* E. L. THORP. *Second Edition, Revised. Pp.* 347. *(London: C. Griffin and Co.* 1918.) *Price 21s.*

BULLETIN OF THE IMPERIAL INSTITUTE. *Vol. XVI. No.* 4. *October-December,* 1918. *Pp.* 605. *(London: John Murray.) Price 2s. 6d.*

THE CULTIVATION, COMPOSITION AND DISEASE OF THE POTATO. *Supplement to the Journal of the Board of Agriculture. March,* 1919. *(No.* 18.) *(London: The Board of Agriculture and Fisheries.* 1919.) *Price 6d.*

THE TRANSACTIONS OF THE CANADIAN MINING INSTITUTE, 1918. *Edited by the Secretary. Vol. XXI. Pp.* 444. *(Montreal: 503, Drummond Building.)*

PUBLICATIONS OF THE UNITED STATES GEOLOGICAL SURVEY. DEPARTMENT OF THE INTERIOR. *(Washington: Government Printing Office.* 1919.)

POTASH IN 1917. *By* H. S. GALE *and* W. B. HICKS.

COBALT, MOLYBDENUM, NICKEL, TITANIUM, TUNGSTEN, RADIUM, URANIUM, AND VANADIUM IN 1916. *By* F. H. HESS.

NATURAL-GAS GASOLINE IN 1917. *By* J. D. NORTHROP.

THE PHOSPHATE INDUSTRY.

JAMES HENDRICK.

During the past half century the group of industries which deal with fertilisers has expanded enormously, and whereas at the beginning of that period the British market was the great fertiliser market, at the outbreak of war it occupied but a relatively unimportant position in the world-wide fertiliser trade. Of all the fertiliser industries that which deals with phosphates is the most extensive, and from many points of view the most important. Far greater weights of mineral phosphates, and of the superphosphates made from them, and of basic slag are handled in the world's markets than of any other class of fertilisers. Except under war conditions the sulphuric acid industry depends mainly on the fertiliser industry, and by far the largest use of sulphuric acid is as an intermediate in the manufacture of superphosphate. Bones were the earliest used of the distinctively phosphatic manures, and though the bone manures are very popular with farmers, and are still used as extensively as ever, their use is limited by the restricted supply, and has not expanded during the past half century, and cannot expand to any great extent. Mineral phosphates first came into use after 1840, and for 40 years the expansion was comparatively slow. During this period the chief concentrated manure was guano, and the chief centre of the manure industry was in Britain. After 1880 the supplies of guano began to fall off, as the main deposits were already worked out, but at the same time the use of these fertilisers began to extend greatly, and this expansion took place mainly in other countries while the British market remained comparatively stationary. The development of agriculture, and especially the promotion of agricultural science and education in other countries, both in Europe and elsewhere, had as a natural result the extension of the use of fertilisers in these countries, while the comparative neglect of agriculture and agricultural science in Britain accounts for our relatively slow progress.

Mineral phosphate deposits are found, and have been worked, in many parts of the world. A large proportion of the mineral phosphate used in Britain before 1880 was coprolites obtained from the English deposits in Cambridge, Suffolk, and other counties, but between 1880 and 1900 the production of coprolites gradually fell away and ceased, while at the same time the consumption of American and other foreign phosphates rapidly increased. In the present century the world's supply of mineral phosphates has been mainly derived from the United States and from North Africa.

The greatest expansion in the world's rock phosphate industry has taken place during the present century. In 1900 the total production was estimated at about 2 million tons; by 1913 it had increased to about 7 million tons. At the same time the industry tended to concentrate in a few places where great supplies are obtainable comparatively easily and cheaply, from which water transport can be readily obtained to the great consuming centres, and where the quality of the rock is suitable for the manufacture of superphosphate. For these reasons the production of phosphate has increased enormously in Florida and Tunis, while owing to their failure to comply with one or other of these conditions the production has fallen away or ceased altogether in other centres, such as South Eastern England.

In 1888, when the phosphate deposits in Florida first began to be worked, the total production of phosphate rock in the United States was about 440,000 tons; by 1895 it had risen to over 1 million tons, and in 1913 to over 3 million tons, of which over 2½ million tons were produced in Florida.

The first part of North Africa to develop a raw phosphate industry was Algiers, where production began about 1893. By 1900 the Algerian production was about 300,000 tons, but it has not increased greatly since, and in 1913 had reached about 450,000 tons. Production in Tunis did not begin till 1899, and in 1900 it reached about 170,000 tons, but by 1913 this had expanded to 2¼ million tons, and Tunis had become by far the greatest source of supply of rock phosphate for Europe. The latest of the North African countries to enter the field as a producer of phosphate is Egypt, which began production in 1910 with a little over 2000 tons, and in 1913 produced about 100,000 tons.

Next in importance to the United States and North Africa as producers of rock phosphates are certain islands in the Pacific, Christmas, Ocean, and Naura Islands, which produce rock of very high quality which largely goes to supply Far Eastern consumers like Japan and Australia. The production in these islands before the war had reached nearly half a million tons per annum. Other important producers of raw phosphates are France and Belgium, but the quality of the material produced in these countries is not so high as that of Florida and the Pacific Islands or even as that of North Africa, nor is the quantity produced so great.

While the United States exports large quantities of mineral phosphates, this country is now by far the largest consumer of its own phosphate which is used chiefly in the Eastern States. The chief importing countries, with the total quantity of raw phosphate imported in each of the years 1905 and 1913, are shown in the following table, the figures for which are drawn from the statistics published by the International Institute of Agriculture :—

	Metric tons 1905	Metric tons 1913
United Kingdom	427,744	547,666
France	446,722	940,791
Germany	501,048	928,798
Italy	240,144	529,776
Japan...	88,932	331,288
Australia	15,575	162,599

The table shows how very rapidly the import of mineral phosphates was increasing in all the countries mentioned with the exception of the United Kingdom. In addition, France produced at home during the period covered by the table an average of nearly 400,000 tons of rock phosphate per annum, most of which was used at home.

Rock phosphate is nearly all turned into superphosphate before being used as manure. The production of superphosphate therefore has increased in proportion to the production of rock phosphate. The statistics of the International Institute of Agriculture show that in 1904 the estimated production of superphosphate in the United States was 695,068 metric tons, and in 1913, 3,248,000 metric tons. In France, Germany, Italy, Japan and other countries the production also increased rapidly during the same period. This means that in these countries the production of sulphuric acid must also have been increased at a very rapid rate. In the case of the United States the expansion is so great as to indicate something approaching a revolution both in agricultural methods and in the heavy chemical industry. In the United Kingdom there was no such expansion in the same period.

The greatest rival of superphosphate in the world's markets as a phosphatic manure is basic slag. This by-product of steel manufacture began to be produced about 1880 when the total production

was estimated at about 10,000 tons. By 1900 the production had increased to about 1¾ million tons and by 1913 to over 4 million tons. Though first produced in Britain from a British process, Germany soon passed Britain as a producer and later France and Belgium did the same. At the outbreak of war these were the chief producing countries, but the production of Germany far surpassed all the rest and accounted for more than half the world's supply. Basic slag was also first used as a fertiliser in Germany and was always more appreciated in that country than in any other. Belgium exported the great part of her large production and Britain exported up to the outbreak of war a considerable part of her smaller production, but Germany, by far the greatest producer of all, was also the largest consumer and used at home nearly the whole of her production which in 1913 was estimated at 2¼ million tons.

It is a natural question to consider whether the great expansion in the demand for phosphatic fertilisers which took place between 1900 and the outbreak of war is likely to continue after peace is restored, and if so whether the supply will be able to keep pace with the demand. There seems little reason to doubt that the expansion in the demand for these and other fertilisers will continue for many years to come, and one cannot at present put any limit to the dimensions which this demand may ultimately reach. It is no longer open to argument that crop production is increased by the proper use of fertilisers, and statistics of crop production show that it is just those countries which have been increasing their fertiliser consumption which have been increasing their internal production of food both per acre and absolutely. At present fertilisers are used only in a comparatively few countries to any great extent. Even in these the consumption has by no means reached its limits, but, as has been shown above, expansion was rapidly taking place in most of them right up to the outbreak of war, and will probably continue when things have settled down again. It is, however, in those countries or districts which have not yet begun to use fertilisers at all, or have only begun to use them in small quantities, that the greatest development is to be looked for.

The United States is already one of the greatest consumers of fertilisers in the world, but as yet it is only a few of the Eastern States which consume any large quantity. We have seen how the market for superphosphate has expanded during the present century, yet nearly the whole of the superphosphate is used on a very small fraction of the total agricultural land of the country. Before the whole of the United States can use superphosphate at the same rate as France or Germany or Britain, the production will require to be increased to an extent out of all comparison greater than anything which has yet taken place, for the productive agricultural area of the United States is greater than that of all the countries of Europe outside the Russian Empire as it existed before 1917. Canada has hardly yet learned to use fertilisers at all. Compared with the United States the cultivated area in Canada is as yet small, but it is capable of enormous expansion. Here is another immense market for fertilisers in the future. The case of Argentine is somewhat similar.

In Europe the country of by far the greatest agricultural area is that which used to form the Russian Empire, and if the possible productive area of Siberia is added, we have an area of agricultural land greater than that of any other country in the world. Yet the consumption of phosphates in the whole Russian Empire in 1913 was less than in Sweden or the Netherlands.

In the present century the thickly populated Empire of Japan has become an important consumer of phosphates, and no doubt will continue to increase its consumption, but a far greater and more populous country than Japan is China in which practically no phosphate is used. If China follows in the footsteps of Japan, as seems likely, there should be a market in that ancient agricultural and highly cultivated country for millions of tons of phosphatic manures. This is a market which only awaits intelligent exploitation.

One might continue to refer to other parts of the world, but enough has been said to indicate that there is no reason why the world's consumption of mineral phosphate should not reach 50 million tons by 1950 instead of the 7 million tons used in 1913. At the same time there is no reason why a similar great expansion should not take place in the consumption of basic slag, but in that case the production will be governed by the production of basic steel.

It is known that if the consumption of Chilian nitrate of soda continues to expand as it did before 1914 the deposits from which this important fertiliser is obtained will be worked out in a limited period of years. If the consumption of mineral phosphates expands as contemplated above, will the known deposits be able to meet the demand? At present the United States produces the largest amount of rock phosphate. The Bureau of Soils, U.S. Department of Agriculture, estimates that the reserves of natural phosphates in that country calculated as high grade material of 75 per cent. tricalcic phosphate, amount to 10,677 million tons. The United States alone, therefore, would be able to supply the world with rock phosphates for centuries to come. No similar estimate appears to have been made for the North African deposits, but these also are known to contain immense reserves of material, and the known reserves in other countries are also very large. It is probable also that deposits of workable phosphates will be found in other parts of the world which have as yet been only imperfectly surveyed. There seems then no reason to suppose that there will be a shortage of rock phosphates in any period which need be considered.

It is unfortunate that we have no important deposit in the British Isles, and that we shall therefore require to continue to import this valuable fertiliser. There are, however, important deposits in different parts of the British Empire and it is quite possible that others may be discovered. In recent years we have obtained our supplies almost entirely from the United States and from French North Africa, but it was pointed out above that the Egyptian deposits began to be worked in 1910 and are already assuming some importance. Probably more will be done in future to find out and develop our Imperial resources of rock phosphates.

In the past rock phosphates have been almost always turned into superphosphate before being used in agriculture and therefore the production of sulphuric acid has had to keep pace with the production of mineral phosphates. Is it necessary that this should continue in the future? No doubt there will be great supplies of sulphuric acid available in the immediate future, as the production has been greatly increased to meet the demands of war. For a time, it seems probable that the potential supplies of acid will much exceed the demand, but if the consumption of mineral phosphates increases as anticipated above the world's supplies of acid would soon require to be further increased if the phosphate is all to be used as superphosphate.

Our ideas on this subject have undergone some change and development in recent times. It was at one time commonly supposed that mineral phosphates were not of much use unless rendered soluble by the use of acid. This belief received a rude shock when basic slag came into use. We know

also that soluble phosphates when applied to the soil are rapidly and completely turned insoluble, and that practically no phosphate is washed out in the drainage even when large quantities of soluble phosphate are used. The agricultural public still to a large extent labours under the mistaken idea that superphosphate is a manure like nitrate of soda or sulphate of ammonia, the effect of which is short lived; but experiments have proved that the phosphate of superphosphate accumulates in the soil, so far as it is not taken up by crops, and effects a lasting improvement in fertility. The chief advantage gained by using a soluble phosphate is in distribution. The soluble phosphate passes into the soil in solution and is there precipitated and thus attains a better distribution than can be reached by distributing an insoluble powder, however fine. But this advantage is only a limited one and has to be paid for at a high price. The advantage appears to be still much overestimated. On certain types of soil at any rate it is not nearly sufficient to pay for the greatly increased cost of producing superphosphate. This is illustrated in the following table which is the average of 66 field experiments carried out upon turnips during the years 1911 to 1914 throughout the northern counties of Scotland by members of the staff of the North of Scotland College of Agriculture :—

FIELD EXPERIMENTS WITH PHOSPHATES UPON TURNIPS, 1911-1914.

Average of 66 experiments.

Plot		Tons	cwt.
1.	No artificial manure	13	17
2.	Sulphate of ammonia, potash manure salts, and superphosphates	20	12
3.	Sulphate of ammonia, potash manure salts, and basic slag	20	0
4.	Sulphate of ammonia, potash manure salts, and ground mineral phosphate	19	10
5.	Sulphate of ammonia, potash manure salts, and steamed bone flour ...	20	7
6.	Sulphate of ammonia, potash manure salts, and bone meal	19	11
7.	Sulphate of ammonia, potash manure salts, and dissolved bones	20	3
8.	Sulphate of ammonia, potash manure salts, and mixture of superphosphate and basic slag	20	15
9.	Sulphate of ammonia, potash manure salts, and mixture of superphosphate and ground mineral phosphate ...	20	8
10.	Sulphate of ammonia, potash manure salts, and mixture of superphosphate and steamed bone flour	20	15
11.	Sulphate of ammonia, potash manure salts, and mixture of superphosphate and bone meal	20	11

N.B.—Manure was applied equally on all plots at the rate of about 12 tons per acre. Sulphate of ammonia and 30% potash manure salt were applied equally to plots 2 to 11 at the rate of ½ cwt. of each per acre. An equivalent amount of phosphoric acid, approximately 50 lb. per acre, was given to each of plots 2 to 11. In 8 to 11, one-third of the phosphoric acid was from superphosphate, and two-thirds from the other phosphatic manure.

As is to be expected in field experiments carried out under ordinary agricultural conditions where there are so many varying factors not under control, all sorts of irregularities were found in the case of individual experiments, and the results of different individual experiments differed greatly among themselves. Thus in some cases none of the manures produced much effect because the soil was in such high condition that a full crop was already obtained from plot 1, while in other cases plot 1 gave only a very poor result and all the other plots showed great increases of crop. Further it is recognised that to complete the experiments the crops should have been measured throughout a complete rotation. This was not possible under the conditions of working.

The general result of the experiments is to show (1) that the average effect of superphosphate is only slightly greater than that of insoluble phosphate, such as basic slag or ground mineral phosphate, when equal weights of phosphoric acid are applied, and (2) that if one-third of the phosphoric acid is given as soluble phosphate and the remainder as insoluble phosphate the average result is as good as when the whole of the phosphoric acid is given as soluble phosphate. Experiments with other crops and especially with grass give a similar result.

The only conclusion one can come to is that soluble phosphate is overvalued, and insoluble phosphate such as exists in basic slag and ground mineral phosphate, undervalued. It should be possible in future to use a large part of the rock phosphate in the form of finely ground powder instead of in superphosphate. This will effect a great saving in acid and in expense.

CHEMISTRY IN THE NATIONAL SERVICE.

FROM THE PRESIDENTIAL ADDRESS TO THE CHEMICAL SOCIETY, BY SIR WILLIAM J. POPE, MARCH 27, 1919.

Four years ago all available chemists were called to the Army, and many of those who formed the nucleus of the Gas Warfare Service are now returning to the industrial and scientific life of the Empire. The development of gas protection methods, which on account of their success were adopted by our Allies, formed a small part of the enormous chemical problem which led to the organisation under Lord Moulton of the Department of Explosives Supplies. Eventually all the resources of the Empire were called in to furnish the necessary war materials, among which were liquid chlorine for the manufacture of phosgene, sulphur chloride, carbon tetrachloride, bleaching powder, and explosives.

At the cessation of hostilities this country was manufacturing per annum 100,000 tons each of nitric acid and of sulphur trioxide with an efficiency respectively of 93 and 91 per cent. theoretical, as well as 60,000 tons of TNT and 35,000 tons of cordite. These productions were on a permanent basis, and centralised in Government factories not only for economy's sake, the cordite made being better in quality and only half as costly as that imported from America, but also for certainty of supply, risks of oversea transport being thereby avoided.

Economy has led to the elimination of picric acid as an explosive. Picric acid costs £185, ammonium nitrate about £50, and TNT about £100 per ton. A mixture of 80 parts of ammonium nitrate with 20 parts of TNT constitutes amatol, which is 5 per cent. more powerful than picric acid, less " brisant " and more difficult to detonate. Consequently the cheaper amatol has completely displaced picric acid in this country as well as in America, and is superseding the latter explosive in Italy and France.

The chemical factories of Central Europe were easily and quickly adapted to war purposes, whereas amongst the Allied nations the necessary plant could be developed only gradually. It is pertinent, therefore, to ask why such gradual development was permitted. The following example furnishes an answer.

In July 1917 the Germans first employed " mustard gas " — $\beta\beta$-dichlorethyl sulphide $(CH_2Cl{\cdot}CH_2)_2S$. This substance has little odour, and causes few fatalities, but induces pneumonia, pro-

duces painful sores, and temporary or even permanent blindness; it was used with great success, and the casualties were very numerous.

The preparation of ββ-dichlorethyl sulphide, described by Victor Meyer in 1886, involves the following reactions:

$$(1)\ CH_2:CH_2+HClO=CH_2Cl\cdot CH_2\cdot OH.$$

$$(2)\ 2CH_2Cl\cdot CH_2\cdot OH+Na_2S=(HO\cdot CH_2\cdot CH_2)_2S+2NaCl.$$

$$(3)\ (HO\cdot CH_2\cdot CH_2)_2S+2HCl=(CH_2Cl\cdot CH_2)_2S+2H_2O.$$

Operation (1) is difficult and the products of (1) and (2) are soluble in water; hence the whole manufacture by these reactions, which were undoubtedly carried out by the Germans, was troublesome, and the yield was perhaps 40 to 60 per cent. of the theoretical. Because of these difficulties the Central Nations thought they had a monopoly in the manufacture of "mustard gas." The German method of manufacture appeared amazing and irrational to British chemists, who by the end of January, 1918, had worked out a method of manufacture represented by the single equation: $2CH_2:CH_2+S_2Cl_2=(CH_2Cl\cdot CH_2)_2S+S$, which produced from 98 to 99 per cent. of the theoretical yield. The new method was employed by France and America, and at the conclusion of the armistice the Allies were making as much "mustard gas" in a day as the Central Nations made in a month. Thus the question is answered: the German chemical service was inefficient; the scientific chemists under its control were incompetent. Further, whilst the Allied potentiality for making "mustard gas" was thirty times that of the German, the German product was thirty times as costly as that of the Allies.

Although the German chemist was incompetent, the skill and perseverance of the German chemical manufacturer were of a very high order. Whilst our activities were of war-time importance, and our works will now need to be dismantled, the German expansions constitute a permanent addition to chemical plant. Consequently Germany now possesses vastly increased resources for the manufacture of essential chemical products.

The opinion that this country is superior to Germany in creative scientific power has been vindicated during the past four years. The previous superior position of Germany as regards applied science was due to a keen public and official appreciation of the economic fruits of scientific effort, in contrast with our neglect of the same. And although it will be long before Central Europe regains its former predominance, there appears to be little prospect of sufficient official encouragement being given in this country to scientific industry to ensure our position in competition with other nations.

Since her entry into the war in July 1917, America has thoroughly organised her chemical resources, but eighteen months was not time enough for the organisation to make its efforts properly felt. Indeed, practically all the American chemical equipment, both for offence and defence, was based on plans furnished by Great Britain and France, because time did not permit of American genius for novelty and magnitude of production having full play. Moreover, many American officers have had the run of chemical works in England and France, and have now returned to America with their experience. Consequently, an increasingly keen competition between Europe and America is to be expected, and it does not appear that this will turn in our favour.

During the first three years of the war, chemical industry, which flourished freely in America, was hampered here by State control of works, material, and labour. On the manufacture of saccharin, installed in England after the outbreak of war, a profit of only 10 per cent. was allowed, and this profit was subject to the excess profits tax; and further, to prevent competition with sugar, an extra 30*s*. per lb. was charged, and appropriated by the Government. Meanwhile America was manufacturing saccharin free from Government control, selling it in this country unrestricted, and securing the thirty shillings, in addition to a considerable profit on account of cheaper manufacture. Having thus accumulated large profits at this country's expense, America is now selling saccharin here at 11*s*. per lb.—a price at which we cannot produce it—with the view of destroying the English manufacture and then running up the price. Regulations of sale with regard to acetic acid, glycerol, acetone and methyl alcohol and their products furnish similar examples of the way in which British procedure has facilitated profiteering in foreign countries during the war. The question is how the problems thus introduced are to be solved advantageously for Great Britain in the coming reconstruction. And we are forced to consider, in view of the future, whether the free play given to scientific creation and production during the war is to persist unhampered. There is no reason to think that the lesson has been properly learnt, or to doubt a re-establishment of the former parsimonious treatment of scientific effort. The control of scientific research is again leaving the hands of the scientific man and being resumed by the lay administrator, for the non-technical administrator is suspicious of the scientific expert because he knows not how to distinguish him from the charlatan of alchemical times.

Scientific research, assisted by the State, must be administered by men of scientific training and eminence. In this regard a lesson may be learned from America. In 1916, President Wilson nominated a "National Research Council" under the presidency of Prof. G. E. Hale, one of the most eminent American men of science. Two points in connexion with the American programme were: first, the substitution of the professional lay administrator by the ordinary office staff; secondly, the recognition of the close interdependence of pure and applied science, which, chemically speaking, involves research work in intimate contact with manufacture, and the chemical investigator as the inspirer of new enterprise. For the nation possessing an extensive organic chemical industry controls not only chemical warfare, but many of the arts of peace. As illustrations of recent work done by this National Research Council may be cited the atmospheric oxidation of naphthalene to phthalic acid by means of a catalyst, with a 95 per cent. yield, and the establishment of a huge nitrogen fixation scheme. Unless British men of science are given similar power, our Empire will, as previously, continue to fall behind other great nations as a contributor to pure and applied scientific knowledge.

During the past year fifteen Societies have collaborated to establish a Federal Council for Pure and Applied Chemistry, the functions of which are to advance, safeguard, and voice the interests of chemical science. This Council is already making its influence felt; and a similar project is being executed in France. A central house to provide adequate accommodation for the various chemical societies should be provided, together with a great chemical library, and a comprehensive scheme for publication of chemical compendia. This is an imposing and costly programme for the Federal Council, but the universal approval of the creation of the Council augurs well for its success.

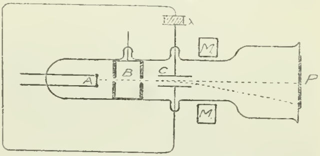
PIEZO-ELECTRICITY AND ITS TECHNICAL APPLICATION.

J. S. G. THOMAS.

In the older electrical text books, the electric eel, the torpedo or ray, percussion, pressure, evaporation, etc., were generally mentioned in a half apologetic manner as some of the more recondite sources affording electrification. The production of electrification by heating or cooling is best exhibited by tourmaline, the Lapis Lyncurius of Pliny, and the phenomenon is termed pyro-electricity. Curiously, the production of electrification by pressure, the phenomenon of piezo-electricity, is also exhibited very strongly by crystals of the same material, likewise by crystals of mica, calcite, quartz, and probably by all crystals possessing skew symmetry, these same crystals being those exhibiting the familiar colour phenomena, commonly referred to as "rings and brushes," when traversed by polarised light which subsequently passes through an analysing Nicol. The relation of these optical phenomena to the molecular arrangement of the crystal structure has been very thoroughly investigated in recent years. There is no reason for doubting that the phenomena of piezo-electricity are likewise very intimately connected with the molecular structure of the crystal. The main phenomenon as exhibited by tourmaline was accidentally discovered by some Dutch jewellers in 1703. They found that when pressure is applied at opposite ends of the crystal, electrification is induced on the surface of the crystal, the exhibition of electrification being most marked at the ends, which become, in the language of the older electrical terminology, positively and negatively electrified respectively. We can roughly visualise the process of electrification, if we regard the crystal molecules as in some way stratified askew to the line of pressure. The resultant molecular motion of the skew crystal surfaces resulting from pressure can be regarded as the cause of the electrification. The necessity for utilising crystals possessing skew symmetry with regard to the line of pressure is clearly seen from the theory briefly adumbrated. The inter-relation of the phenomena of piezo- and pyro-electricity was established by Curie, who showed that tension and compression of a tourmaline crystal were accompanied by heating and cooling of the crystal respectively. A tourmaline crystal under compression behaves electrically like a cooling crystal. The further discovery was made by Curie that the quantity of electricity developed by pressure was exactly proportional to the pressure, and the ratio of pressure to electrification is independent of the thickness of the crystal plate.

In a lecture delivered at the Royal Institution on April 11, Sir J. J. Thomson has re-directed attention to the possibilities of this little-explored domain. Incidentally, utilising the phenomena appertaining to another branch of so-called "pure science," he has shown how the two branches can be combined in a manner which has already yielded and promises to yield results of great importance scientifically and industrially. It required no little scientific discernment to realise in the phenomena of piezo-electricity the means of measuring with great accuracy the extremely large pressures developed during the explosion of a gas or guncotton, and to follow the variations in pressure occurring during the explosion. This has been achieved in the following manner. A plate of tourmaline can be subjected to pressure and the electrification thereby excited readily measured. The linear relation of electrification to pressure then enables one to deduce the pressure from the electrification exhibited by the crystal. The phenomena of the cathode discharge are amongst the scientific commonplaces of the present day. A stream of negatively electrified corpuscles is emitted from the negative electrode or cathode in an ordinary discharge bulb. These electrons are the fundamental units out of which all matter is built. They are emitted from a metallic filament raised to incandescence, a fact which is of no little consequence in the design of the more efficient types of electric incandescent filament lamps. Ordinarily, these electrons travel in straight lines, but owing to their negative charge they are deflected when exposed to an electric field, and the amount of the deflection can be made to serve for the determination of the strength of the field through which the electrons have passed. The strength of the electric field being known, the quantity of electricity producing such field is readily calculated.

The procedure adopted by Thomson for the recording of the pressure developed during the course of an explosion wave is illustrated in the accompanying figure, and is as follows:—A stream of electrons is emitted from the heated tungsten filament A contained within an exhausted vessel of the form shown. A narrow beam of electrons is determined by their passage through the narrow apertures shown at B. The opposite faces of a tourmaline



crystal cut at right angles to a principal axis are put in metallic connexion with the parallel aluminium plates C. So long as these plates are electrically uncharged, the electrons pursue a straight path, and their incidence centrally upon the screen or photographic plate P is marked by a central luminous spot. The tourmaline plate X being exposed to pressure developed during the course of an explosion within a chamber enclosing the crystal, the plates of C, being in electrical connexion with the electrified faces of the crystal, would become electrified, and the path of the electrons between the plates would become curved. Emerging from between the plates, the stream of electrons would now meet the screen P in a deflected position as shown, the direction of deflection—whether up or down—being determined by the signs of the respective electrification of the plates C. The amount of the deflection being proportional to the electrification of the plates C is readily seen to be proportional to the pressure developed within the chamber enclosing the tourmaline crystal. In this manner it could be quite easy to record the maximum pressure developed during an explosion lasting 1/100,000th sec., the limit of time being set by the sensitiveness of the photographic plate. In order to follow the fluctuations of pressure with time, the photographic plate might be moved across the beam of electrons, a time-pressure curve being obtained in this manner. The method, however, is difficult to apply in a vacuum. A much better method utilises another property of the electrons, a property ultimately based upon the classical researches of Oerstedt, *viz.*, the deflection of a conductor conveying a current in a magnetic field. The stream of electrons behaves like a conductor conveying a current, and being subjected to a mag-

netic field represented by MM situate just beyond the plates C, the beam would be deflected in a direction at right angles to the plane of the diagram, being towards or from the reader according to the direction of the magnetic field. Moreover, the magnitude of this magnetic deflection would depend upon the magnitude of the magnetic field. If, therefore, a rapidly alternating magnetic field were employed, the spot formed by the beam of electrons would move in a line at right angles to the plane of the diagram if the crystal were not subjected to pressure. The crystal being subjected to pressure, and the alternating magnetic field being simultaneously employed, the path of the spot is determined by a deflection in one direction determining the pressure, and in a direction at right angles determining the magnetic field. This latter varying harmonically, a subsequent analysis of the curve traced on the photographic plate enables a pressure-time curve to be readily constructed.

The method of explosive pressure measurement thus made available possesses the advantage over the forms of pressure indicators hitherto used in that inertia effects are reduced to an absolute minimum. The mass of the electrons is approximately 1/1800th part of that of the hydrogen atom, and their deflection, as described, can readily be effected in 1/100,000,000 sec. In guns and engines the pressure-changes develop with great rapidity, the whole explosion taking about 1/50,000th sec. On this account the interpretation of the indications of mechanical recorders of pressure is a doubtful procedure. The electron method, however, is not vitiated on this score. Its application to the elucidation of the power and time constants of high explosives, the explosive phenomena in guns and internal-combustion engines, the effects of different kinds of petrol, the explosion of mixtures of air and various gases, the explosive effect of magnetic sparks, promises to yield results important both scientifically and industrially. The propagation of an explosive wave through a tube or solid can be readily followed by employing two or more crystals in different parts of the tube or solid. To some of these problems the method has already been applied. Sir J. J. Thomson has investigated the explosion of gun-cotton in sea-water. The attainment of the maximum explosive pressure is succeeded by a smaller peak on the descending part of the pressure-time curve. The interpretation of this second peak is obscure. A later peak represents the arrival of the explosive-pressure wave reflected from the sea bottom.

The method above outlined is probably unique in that it combines a number of discoveries of pure science—the phenomena of piezo-electricity, cathode rays—their electric and magnetic properties—in such manner that the result promises to be of extreme importance industrially. The discovery of cathode rays led to that of Röntgen rays. It now promises to yield further fruit of technical importance. After this, who shall say "Pure science is a thing apart"? Pure and applied science are one and indivisible.

Industrial Research and the Supply of Trained Scientific Workers.—A report on this subject by the Education Committee of the British Science Guild contains statistical data showing the relative paucity of the provision for higher scientific studies in Great Britain as compared with the United States and Germany. In 1913—14 there were only 5000 full-time students of science and technology in the United Kingdom, in comparison with nearly 17,000 in Germany and 34,000 in America. The total income of Universities amounts to:—U.S.A., £20,000,000; Germany, £1,800,000; U.K., £2,000,000, or about £1,000,000 excluding Oxford and Cambridge.

NEWS FROM THE SECTIONS.

YORKSHIRE.

The annual meeting was held at the Queen's Hotel, Leeds, on April 14. After a vote of condolence to Mrs. Fairley had been passed and the officers and committee elected for 1919-20, Mr. B. G. McLellan opened a discussion on "The Separation of Solids from Liquids." The subject was divided into: (1) Sedimentation and (2) Filtration. Under the first heading the settling process as in water softening was discussed, and the closed basket centrifuge was included as a modification of sedimentation. During the latter part of the discussion the chairman (Mr. W. McD. Mackey) described his Inclined Tank System as installed at Bradford. Continuing with the second heading, Mr. McLellan subdivided filtration into (*a*) gravity, (*b*) pressure, (*c*) suction, and (*d*) continuous processes. As an example of the gravity type, the Taylor bag for sugar work and the ordinary perforated basket centrifuge or hydro-extractor were described. The working of the filter press was then given in detail. To decrease the time and labour of emptying and fitting cloths to the ordinary type of filter press, the American Leaf Presses of Sweetland and Kelly have been devised. Double-faced filtering leaves or plates are suspended in a closed cylindrical vessel into which the liquor is forced. Filtration occurs through the leaves inwards, the cake forming on the outside. At the end of the operation the lower half of the cylinder is dropped and the cake removed, when on closing the cylinder the plant is immediately ready for further work. The Oliver Continuous Filter was also described.

A short note on "The Iodine Value (Wijs) of Palm Kernel Oil," by Messrs. Ellis and Hall, was read by the latter. It was pointed out that the constants as given in the literature for expressed oil (varying from 10 to 17) were too low. The authors from tests of over a thousand commercial samples had found a range of from 15 to 23, the average being 18·5. A few preliminary laboratory tests seemed to show that extracted oil (by ether) gives lower values, namely, 15—19, with an average of 16·5.

BIRMINGHAM.

The newly formed Engineering Group was the subject of an address and discussion at a meeting held on April 10. Dr. R. S. Morrell presided. Prof. J. W. Hinchley, who had been invited, was unavoidably prevented from attending, and the address was therefore given by Mr. C. S. Garland. The aims of the new Group were explained. These included, *inter alia*, training and research, a circulating technical library, an information bureau to supply data but not advice, compilation of manufacturers' catalogues and price lists of plant and apparatus. The chemical engineer was defined as a chemist who transferred results obtained in the laboratory to operations conducted on an industrial scale. Commercial success in industrial chemistry depended upon a combined knowledge of the chemistry of a process and of the proper mechanical and structural means of applying it on a large scale. Mr. H. Talbot stated that the membership of the Group was about 500 and that interest in the Group was steadily growing. The discussion was generally appreciative and showed a strong desire amongst many members of the Birmingham Section to participate in the work of the Group. Several members stated that they were already forming a library for manufacturers' catalogues and offered to co-operate in assisting the Group in this valuable work. The dual character of the work carried on in operations in chemical industry was generally emphasised, and it was recognised that the attempts to carry on such

operations by the co-operation of chemists and engineers had frequently proved unsatisfactory and inefficient. The opinion appeared to be unanimous, that better results and smoother working could be obtained from the efforts of one individual possessing both chemical and engineering knowledge, *viz.*, the chemical engineer.

LIVERPOOL.

The annual meeting of the Section was held at the Liverpool University on April 11, Mr. A. T. Smith presiding. After the formal business followed a paper by Mr. W. Ramsay Sibbald on "Continuous Process Plant Design."

The aim of modern manufacture is to effect a continuous treatment of material from the raw condition to the finished product, with a view not only to a perfect return for energy expended, but also to uniformity of quality. In the laying-out of plant, therefore, due thought is directed towards eventual reduction of (*a*) maximum "power figure," (*b*) personnel of controlling staff, (*c*) amount of material under treatment at one time, (*d*) size of machine and parts, etc., and of space occupied. The desirable objects to be attained are—standardisation of products, highest percentage yields, effective use of heat otherwise wasted, etc. The term "chemical plant" covers appliances in which are carried out purely physical processes for the most part, and in designing such plant similar principles apply whether the aim of the chemist-engineer be to achieve the transference of a calorie of heat from one body to another or the removal of an atom or radicle from one molecule to another. The desiderata in either process are (i) thorough contact of materials, (ii) maintenance of this until the desired exchange or union has taken place, (iii) to permit no avoidable waste of heat, power, or material so far as may be possible.

The principal limits to chemical processes are set by the law of mass action and the phase rule, and to obtain the highest proportion of the desired products in the final resultant mixture it is necessary first to work out the optimum conditions of temperature, pressure and concentration. In physical processes, *e.g.*, heat transference, as in condensation, cooling, solution, etc., the physical laws are applied—for instance, condensers or coolers are designed so that one fluid flows in one direction through pipes or coils immersed in the other fluid which is made to flow in the contrary direction. Again, in industrial chemistry, the time occupied in the completion of a reaction is important, and is often required to be reduced to a minimum, *e.g.* by stirring apparatus, spraying devices, and air currents, etc.

Briefly the main feature of continuous process plant design is the provision of counter-current systems for the various physical and chemical exchanges or reactions, whether between gas and gas, gas and liquid, liquid and solid, or solid and gas, so that the end-product is brought away from the sphere of greatest physical or chemical action and its place rapidly taken by fresh material (while the reactant proceeds similarly in an opposite sense or direction) at a speed which is convenient and economical.

GLASGOW.

The following officers have been elected for the session 1919-20.—Chairman, Mr. Quintin Moore; vice-chairman, Prof. C. H. Desch; hon. secretary and treasurer, Dr. G. S. Cruikshanks; Committee—Dr. T. Ewan, Prof. T. Gray, Messrs. J. McLeod, L. Hislop, W. S. Herriot, J. Hope, S. H. B. Langlands, D. A. McCallum, J. McFarlane, J. McGregor, J. McWhirter, Jos. Robertson, Jas. Robertson, R. T. Thomson, J. H. Young, and W. W. Wilson. The report for the past year states that seven meetings have been held of which four were of an informal nature.

MEETINGS OF OTHER SOCIETIES.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

On April 1, Mr. Wm. Thomson presiding, Lieut. W. A. Macfadyen read a paper on "Electrolytic Iron Deposition." The object of the work described was to obtain data upon which an industrial process could be founded for salving worn steel parts by electro-plating them with iron. With ferrous ammonium sulphate as electrolyte excellent results were obtained with dilute solutions at room temperature, but the deposition was very slow; with a concentrated solution the results were equally good but the rate of deposition was about 7 times faster; with a concentrated solution at 60° C. 50 times faster than with a cold dilute solution. Varying acidity had a great effect on the deposits, the best results being obtained with an electrolyte about ·005 N with respect to sulphuric acid. Iron can be deposited directly on to steel, and subsequent heat-treatment produces an adhesion of the deposit to the basis metal very much better than the best attainable by simple plating, and the deposited iron is much tougher than before treating, although it is considerably softer. Such deposits can also be case-hardened with good effect.

INSTITUTION OF PETROLEUM TECHNOLOGISTS.

Sir Boverton Redwood presided at the annual meeting held at the Royal Society of Arts on April 15, the retiring president Mr., now Sir, Charles Greenway being absent owing to illness. In a valedictory letter, the latter referred to the need for increasing the scope and activities of the Institution, and suggested that a special membership should be instituted for the large oil companies at a subscription of 250 guineas yearly.

The new president, Sir Frederick Black, then delivered an address on "Some War Problems of Petroleum Supply." The main problems were specified under three heads (1) The production of sufficient supplies for the needs of the war; (2) the adjustment of the processes of refining to the provision of increased quantities of heavy fuel and of petrol, particularly for aviation purposes; (3) the provision of sufficient tank steamers and tank cars for distribution by sea and land. In addition the oil industry was called upon to furnish certain products for use as high explosives. In this connexion the extraction of toluene from Borneo oil proved a great help; experiments were also undertaken to obtain similar results with petroleum from other sources. After referring to the "key" nature of the petroleum industry and to the enterprise shown by the great oil companies in opening up new sources of supply, erecting refineries, building pipe lines and tank steamers, the author alluded to the problem of home production of oil from shale and cannel coal, and stated his conviction that although such production will have special difficulties of cost and disposal of products to contend with, it will nevertheless become one of the sources of supply that the market will need. Sir F. Black then related his experiences during his visit to the United States with the British War Mission arranging for supplies of oil and tank steamers, both of these objects being eventually attained. In regard to ocean transport, the carriage of oil in double-bottom ships did more than any other single effort to relieve the situation; over one million tons of oil were conveyed overseas by this means. The inestimable services of the Navy may be realised from the fact that in the 4¼ years of war about 250 million tons of British coal and about 30 million tons of oil from all sources to all ports

of the Allied countries in Europe were transported safely overseas. The remainder of the address was devoted to the main problem of the future, *viz.*, the adequacy of petroleum supplies. A leading American expert, Mr. M. Requa, has expressed somewhat pessimistic opinions concerning the future supply in the United States, but he is very hopeful in regard to production from shale. The U.S. Geological Survey estimates that about 40 per cent. of the entire known petroleum sources of the country has been exhausted. Assuming that new areas of equal productivity to those already known will be discovered and worked, American oil supplies, excluding Mexico, have a life of only 30 years. The world's demand for petroleum products will increase greatly; this demand will be met for some time by the development of new sources, including those of carboniferous and vegetable origin, but the conservation of supplies and the avoidance of waste are from all points of view imperative.

THE FARADAY SOCIETY AND THE RÖNTGEN SOCIETY.

The joint meeting held by the above Societies at the Royal Society on May 1 was of unusual interest. The past few years have shown the urgent need for the detailed examination of ferrous, non-ferrous and other products upon which human life depends, and it is thought that the method of examination by means of X-rays has a great future before it. Such a method might, as Sir Robert Hadfield pointed out, prove costly to the manufacturer at first, but the knowledge gained and the improvements acquired would more than compensate in the future. A great deal of work has been done on the subject of "Radio-metallography" during recent years in this country, America, France, Japan, and Germany, and the results obtained give every encouragement for future research. Summaries of the most important work were dealt with by the chairman, Sir Robert Hadfield, in opening the discussion.

Professor Bragg, in giving an introductory account of the subject, said that engineers and metallurgists must realise that they are using a new power which is denied them in the case of light, the difference being the shortness of wavelength which enables X-rays to penetrate substances of the most delicate nature and, equally well, several centimetres of steel. At present the work is being carried out on a relatively small scale, but Mr. Campbell Swinton hoped that in the near future the question would be attacked from the engineer's point of view, and that much larger powers would be used. This point was emphasised by Capt. Knox and Major Kaye and by Monsieur Pilon and Mr. Geoffrey Pearce, who thought that future success with X-rays depends on improved equipment, and it is on those lines, rather than on application, that research should tend. At present the available equipment is satisfactory for the examination of aluminium and light alloys, though further progress might be looked for; but for iron and alloy steels different equipment is required to make X-ray examination practical. In X-ray photography, many practical details need attention according to the material to be examined, such as the kind of radiations used, plates and intensifying screens, time of exposure and development. Mr. Renwick and Dr. Slade both dealt with the subject and pointed out that the same contrast would be obtained with soft radiations through a thin layer as through a thick, provided a longer exposure is given; with harder radiations and the corresponding shorter exposure, less contrast is obtained.

X-ray examination has been used in the laboratories of Mons. Schneider at Le Creusot for determining segregations, blow-holes, foreign bodies, faulty welds, defects in gear cases of aircraft engines, hair cracks. Radiography might also be used for the rapid examination of steels containing varying amounts of tungsten and the examination of compound metals. For the examination of timber for aircraft, this method is of great value. Using soft radiations, defects, due to natural flaws in the wood, resin pockets, diseases, or to defective workmanship, which would possibly cause serious injury to the airmen, are easily revealed.

Several very beautiful photographs were exhibited by different workers, including Prof. Bragg, Capt. Knox and Major Kaye, also some striking radiographs of carbon electrodes by Sir Robert Hadfield. Other exhibits and demonstrations were given by various workers, including the apparatus used at the War Office X-ray Laboratory for testing definition of X-ray bulbs, exhibited by Major Phillips.

SOCIETY OF GLASS TECHNOLOGY.

The annual meeting was held in Sheffield on April 16, with Mr. W. F. J. Wood, the retiring president, in the chair. In a short presidential address, Mr. Wood spoke of the impending establishment of a Glass Research Association (this J., 1919, 133 R), stating that at an early date all glass manufacturers would be invited to join it, and that substantial subscriptions had already been promised. After a description of industrial research in the United States had been given by Mr. A. P. M. Fleming, of the British Westinghouse Co., Sir Frank Heath, Secretary of the Department of Scientific and Industrial Research, addressed the meeting. He pointed out that the glass industry has been engaging the anxious consideration of the Government, as much, if not more, than any industry in the country since the war began. During the war the Department had been enabled to help the industry in many ways, and would do so in future. He could not help feeling that too much dependence upon State aid indicated an unhealthy condition in industry. It ought not to be necessary for any industry to look outside itself for direct and immediate aid in the conduct of its work.

The Department of Glass Technology of the University of Sheffield was opened to inspection, and members had the opportunity of seeing the vacuum casting of a large glass pot of 38 in. diameter. The first annual dinner was held in the evening. The president for the ensuing year is Mr. S. N. Jenkinson.

SOCIETY OF PUBLIC ANALYSTS.

At the meeting held on May 7, Dr. S. Rideal presiding, Messrs. T. F. Harvey and F. Mackley read a paper on "The Analysis of Mercury and Zinc Cyanide and of Double Cyanide Gauze." Double cyanide gauze, so extensively used for field dressings during the war, is prepared by impregnating large rolls of gauze with a previously prepared paste containing about 50 per cent. of mercury and zinc cyanide. The authors described rapid methods of analysis for the control of both paste and finished gauze.

"The Estimation of Small Quantities of Antimony," by Dr. W. Beam and Mr. G. A. Freak, described a modification of the process proposed by Schidrowitz and Goldsbrough. The antimony is deposited on copper foil, dissolved in boiling alkaline permanganate solution, reduced with sulphur dioxide, and then converted into colloidal trisulphide in the presence of gum. Colorimetric comparison is then made with solutions prepared from a standard potassium antimonyl tartrate solution.

ROYAL SOCIETY OF ARTS.

A series of three Cantor lectures was delivered by Prof. W. A. Bone during March on "Coal and its Conservation."

Of all important raw materials produced in this country, coal is the only one of which the output is in excess of national requirements. There is, moreover, so far as Great Britain is concerned, no real alternative to coal as a source of heat and power on any large scale, the total available water power being capable of generating only about 8 per cent. of our present requirements, and amounting to about 1/30th of that available in the United States or Canada. The estimate of the world's coal supply in 1913 was 7,397,553 million tons, of which 69 per cent. is located in America, 17·3 per cent. in Asia, 10·6 per cent. in Europe, 2·4 per cent. in Oceania, and 0·6 per cent. in Africa. In 1905-07, the output of coal per person was, in the United States 589 tons, and in Great Britain 289 tons. In 1908-10 the figures were, respectively, 591 tons and 265 tons, and in 1911-13, 651 and 254 tons. The pithead price of coal in Great Britain has risen from 12*s.* 5½*d.* per ton in 1915 to 25*s.* in 1919. The consumption of coal in the United Kingdom in 1913 was distributed amongst the several industries as follows (the figure in each case denotes million tons):—Mines and factories 80, metallurgical industries (including iron and steel) 32, bricks, ceramic, glass, chemical manufacture 6, railways and coasting steamers 17, gas works 19, domestic purposes 35, making a total of 189 million tons.

The future policy of this country as regards power production should be to utilise low grade fuels for this purpose, and to export the better grades of steam coals. All coals intended for use in iron and steel smelting, and for domestic purposes, should be carbonised with by-product recovery before such use. By-product recovery—partial or complete—should likewise be applied to coal consumed for power purposes. The essential differences in the products yielded by high and low temperature carbonisation processes were briefly discussed, and it was pointed out that by gasifying the coke, 60 per cent. of the heat value of the coal can be obtained in the gas. Caution was urged in regard to the adoption of the suggestion of Dr. Carpenter that gas should be charged for on a basis of its potential heat units. It would not be good policy to send low grade gas through the mains. Moreover the chemical composition of the gas as influencing its safety and convenience in use, is of consequence.

The final lecture was devoted to the question of power supply as a problem in industrial reconstruction. The 1907 Census of Production accounted for 10 million h.p. in the factories of the kingdom, 26 per cent. of the prime movers being electrical. The total electrical power generated was 2388 million kilowatt years, of which about 62·5 per cent. was generated for public utility services. The load factor in co-operative generation was only 16 per cent. The average efficiency of the conversion of heat energy of coal into mechanical power *via* steam-turbine, dynamo, is about 4 per cent., representing a consumption of about 5 lb. of coal per B.H.P. hour. In the process of conversion, 96 per cent. of the heat of the coal is lost. Gaseous fuel is unchallenged as a medium for heat distribution, as is electricity, according to the lecturer, for power. There seems to be little to choose between steam and gas systems for the purpose of such power production. The efficiency of electric power production is expected to be slightly above 20 per cent. in one of the super-stations now being erected in this country, equivalent to 1 lb. of coal per kw. hour. Results of tests on the 35,000 h.p. Parsons' turbo-alternator at Chicago have indicated a production of 1 shaft h.p. per lb. of coal.

NEWS AND NOTES.

BRITISH INDIA.

Potash from Bitterns.—During recent months the attention of salt manufacturers has been drawn to the possibility of recovering potassium salts from the bitterns remaining after salt recovery. Recent experiments by salt producers have demonstrated the possibility of obtaining potassium salts on a commercial scale from this neglected source, and experiments on a larger scale are about to be undertaken.

Casein Industry in Bombay.—Before the war the Germans investigated the possibility of obtaining casein from India, and considerable quantities were exported to Germany in the years just preceding 1914. But the casein then made was under German direction. After the outbreak of war Indian manufacturers continued to make casein in fairly large quantities, but without technical guidance, and the quality produced was not very satisfactory. The Government helped the producers, and the material is now made at various places in the Presidency by up-to-date methods. This industry bids fair to assume large proportions in the near future.

Substitute for Barley Malt.—The Department of Agriculture in India has published recently a paper in the chemical series dealing with the investigations carried out with the object of finding a satisfactory substitute for barley in malting operations. A large number of cereals was examined, and it was found that "Cholam" or Juar, commonly known as great millet (*Andropogon sorghum*) is a good substitute for barley, although it contains less husk; but this difficulty can be remedied by admixture with malted paddy or bran. Cholam is very largely available in India, and at very cheap rates. Malted foods were prepared, and exhibited publicly, and the results were highly satisfactory. It is to be noted that the malt extract prepared from Cholam hydrolyses starch at a greater rate than barley malt extract, although under identical conditions the proportion of dextrine to sugar produced is greater than with barley.

Manganese Ore.—At a recent meeting of manganese mining companies, the position of manganese ore in India was described by Sir Thomas Birkett. During the past year the mining industry suffered all the disadvantages arising out of war conditions, and consequently production was considerably restricted. New ore formations have been found at the principal mines, but the cost of working has risen considerably owing to increased wages. India has now to be prepared for a serious contingency. The Caucasus mines will again reopen, and there are other mines in Egypt and Africa which threaten formidable competition. Egyptian and African deposits are more favourably situated than those in India for putting manganese ore on the European market, and unless the Government helps the industry by various concessions in regard to transport, the industry has a very gloomy future before it.

SOUTH AFRICA.

A South African Mint.—It is officially announced in the Senate that the Government intends to establish a mint in South Africa. A bill for that purpose will be introduced this session.—(*Reuter.*)

AUSTRALIA.

Copper Production.—Telegraphic advices state that all the copper mines and smelters in Australia, except the Mount Morgan and Mount Lyell, have now suspended operations.—(*The Times, May* 3, 1919.)

Petroleum Discovery in New Guinea.—The Melbourne *Age* reports the discovery of great petroleum wells of high commercial value in the portion of New Guinea captured from the Germans, and states that information obtained by a party of expert investigators from America has been confirmed and amplified since Australians occupied the territory.—(*Official, May* 1, 1919.)

CANADA.

Organisation of Canadian Chemists. — The "Chemists' Organisation Committee," appointed at the Convention of Canadian Chemists held in Ottawa, May, 1918, has issued a preliminary report, which is to be submitted to the second convention to be held at Montreal during May 1919. The main recommendations are, briefly, as follows:—The task of organising chemists in Canada should be carried out by an entirely new and separate organisation, for which the title "The Institute of Chemistry of Canada" is proposed. The membership to consist of Fellows and Associates. The qualifications for the Fellowship should be:—(A) Graduation at a university after a four-year course with chemistry as chief subject; or (B) graduation at a university after a three-year course with chemistry as main subject, followed either by a further year's university training in chemistry, or by two years' experience in an approved laboratory; or (C) five years' active experience—with a responsible position—in either pure or applied chemistry, and the passing of an examination before a board appointed by the Institute. This examination may be waived in the case of chemists already practising at the date of incorporation of the Institute. The minimum age of Fellows to be 25 years, below that age the same qualifications to apply for the Associateship. An Associate to become Fellow on reaching 25 years of age on the recommendation of five Fellows, provided he has practised chemistry for at least two years. All candidates must satisfy the examiners that they have had a good general education.

The objects of the new organisation would be to raise the status of the profession and so attract the best intellects; to have available an organisation that could be consulted by the Government in times of crisis; to protect the public; and to assist chemists by establishing registration and employment bureaux, a library, and centres for social and scientific intercourse.—(*Canad. Chem. J., April*, 1919.)

Mineral Production in Canada.—The preliminary report of the Canadian Department of Mines gives the broad results of production, value, exports, etc. for 1918. The total value of metals and minerals won was $210,204,970, an increase of 10·8 per cent. over 1917, and of 44·3 per cent. over 1913. Out of 45 products listed, 18 reached their highest production in 1918 or 1917. The output of copper in 1918 amounted to 118,415,829 lb., an increase of 8·4 per cent., gold slightly declined to 710,526 fine oz., and silver decreased by 4·2 per cent. to 21,284,607 fine oz. The recorded output of platinum was 39 crude oz. against 57 for 1917, but no definite record of the total recovery of the metals of the platinum group has been obtained. Shipments are reported in 1918 of 8677 oz. platinum and 13,016 oz. palladium. The amount of nickel produced was 92,076,034 lb., an increase of 9·14 per cent.; exports were 1,710,800 lb. of fine nickel and 85,767,700 lb. of nickel in ore, etc. The lead production was 43,846,260 lb., an increase of 34 per cent.; the lead in ores etc. exported rose 70 and pig lead over 600 per cent. The total production of zinc was 33,663,690 lb., much of which was treated in Canada. Iron ores show a further falling off to 206,820 short tons. The ore charged to blast furnaces was 2,242,337 tons. Pig iron production slightly increased, the output being 116,520 tons from blast furnaces and 30,425 tons at electric furnaces. Steel ingots and castings are estimated at 1,893,000 tons, 120,000 tons being produced electrically. The total production of coal was 14,979,213 tons, or an increase of 6·6 per cent., but the Dominion still imports the greater part of the coal it consumes. The output of oven coke was 1,234,347 tons, averaging 0·634 ton per ton of coal. By-product recovery ovens dealt with 71·2 per cent. of the coke produced. There was a slight increase in petroleum output (304,741 barrels), the greater part of the consumption being still imported. Other metals and minerals reported on are molybdenite, arsenious oxide and arsenic, asbestos (output 143,456 tons), chromite (21,994 tons), fluorspar, graphite, magnesite (39,365 tons), pyrites (416,649 tons containing 38 per cent. of sulphur), and salt, the output of which declined by 5 per cent.—(*Bd. of Trade J., April* 17, 1919.)

JAPAN.

Mineral Production in 1917-18.—The reports of the Japanese Bureau of Mines give the following statistics:—

Mineral	Production 1917	Production Jan.-June 1918
	Tons	Tons
Antimony	6,572	—
Chromite	8,798	1,173
Copper	63,812	41,787
Gold (lode)	226,122*	122,632*
Lead	15,557	2,419
Manganese ore	50,552	12,219
Silver	7,111,720*	3,166,344*
Tungsten	721	291
Zinc	53,852	—
Asphalt	3,811	1,414
Coal	25,939,637	13,999,517
Lignite	150,450	76,023
Petroleum, crude	2,850,159†	1,220,968†
Phosphate rock	110,682	112,519
Pyrites	119,426	—
Sulphur	116,120	34,963

* Oz. troy. † Barrels of 42 galls.

The antimony production for 1917 was 30 per cent. less than in 1916, and it is expected to remain stationary for 1918. The reduction of chromite produced was largely due to the United States embargo on imports. The copper output for 1917 is considered to be erroneous, and a large firm of metal brokers corrects the figure to 89,756 tons. In any case there was a large increase during 1917 which may or may not be maintained during 1918. The 1917 lead production represented a 30 per cent. increase on 1916, and large amounts of Australian concentrates were imported during the year. The first half of 1918, for which a corrected figure of 4252 tons is given, shows a big decline which is largely due to the falling off of Australian imports owing to high freights.

The small rise in production of manganese ore in 1917 is expected to be followed in 1918 by a 50 per cent. decrease, also chiefly on account of shipping difficulties, and for a like reason the zinc output, which went up by 50 per cent. in 1917, will suffer a big drop in 1918. The small decline in tungsten output indicated by the 1918 figures must also be attributed to lack of tonnage.

The coal position shows promise of still higher prices as well as of increased outputs, while the petroleum production will be adversely affected by want of well-boring apparatus. The important increase of 75 per cent. in phosphate rock indicates the growth of the chemical industry and the demand for fertilisers. The sulphur markets, as the 1918 figures show, are quite inactive, again for want of shipping facilities.—(*U.S. Com. Rep., Feb.* 19, 1919.)

UNITED STATES.

The Government Nitrate Plants.—An announcement authorised by the Assistant Secretary for War states that much constructive and creative work is needed to adapt the Government nitrate plants to the requirements of peace and to the production of fertilisers. It has been decided to establish forthwith a civilian organisation, to be called the United States Fixed-Nitrogen Administration, which will be under the joint control of the Secretaries of War, Navy, Interior and Agriculture, and will take over the nitrate plants and other interests now administered by the Nitrate Division of the Ordnance Department. Mr. A. G. Glasgow has been appointed first administrator of the new organisation.

"Colloidal" Fuel.—The imperative need for increased supplies of liquid fuel, particularly for naval purposes, has prompted American engineers to investigate the problem of incorporating solid and liquid fuels in such manner that the resultant mixture can be handled and utilised as ordinary oil fuel. The work was carried out under the auspices of the Submarine Defence Association with the assistance of the United States Navy Department, and the results are of importance as they promise not only conservation of oil fuel but also utilisation of low-grade solid fuel.

The use of pulverised coal alone necessitates the adoption of special burning installations, and the difficulties connected with handling and storage render it impracticable as a naval fuel. Attempts made hitherto to blend any appreciable proportion of pulverised solid with liquid fuel have failed because of the sedimentation of the solid. The problem has, however, now been solved by the special incorporation of a "fixateur" whereby a liquid of colloidal nature is obtained. By this means 30—40 per cent. of coal (95 per cent. of which passes a 200-mesh screen) can be suspended in oil for several months without material sedimentation. The composition of the fixateur, which is used to the extent of 1 per cent., is not disclosed. Other substances (not specified) are incorporated, the properties of which have some particular influence upon the combustion and characteristics of the fuel, *e.g.*, dispersion of solid particles, miscibility, viscosity, flash point, melting point, ash and sulphur content, drying, fluxing, and enrichment with combustible elements. Some of these substances may remain in the final product, or, having fulfilled their function, may be distilled off for further use.

One grade of colloidal fuel was devised to utilise some poor quality "anthracite rice" containing 25·5 per cent. of ash and having a calorific value of 10,900 B.Th.U. per lb.: $38\frac{1}{2}$ per cent. of this was incorporated with $61\frac{1}{2}$ per cent. of Pressure Still Oil, wax tailings, petroleum pitch, and fixateur running 18,505 B.Th.U. per lb. The product contained 10·2 per cent. of ash and had a calorific value of 162,500 B.Th.U. per gallon. The calorific value of the fixated oil itself was only 151,750 B.Th.U. per gallon. This increased heating value has an important bearing upon transport costs and upon the steaming radius of ships. Further research was directed towards the blending of petroleum oils and coal tars with coke and asphaltic substances. A stable liquid fuel was made up of oil 45 per cent., tar 20 per cent. and pulverised coal 35 per cent., thereby replacing over one-half of the oil. Asphaltic and free carbon particles in Pressure Still Oil may also be stabilised, thereby rendering a low sulphur oil available for metallurgical uses.—(*"Colloidal Fuel: Composites of Oil, Tar and Carbon," issued by The Submarine Defense Association,* 141, *Broadway, New York.*)

GENERAL.

Suspension of Work at the Avonmouth Spelter Works.—Owing to the greatly increased cost of materials and labour, and the consequent impossibility of conducting operations so as to compete with foreign producers, the directors of the National Smelting Company have decided to close down the works at Avonmouth pending the advent of better conditions. We are informed that existing contracts will be carried out but no new work will be undertaken. The Avonmouth factory was planned on a very large scale primarily to treat Broken Hill concentrates (which in pre-war times were shipped to Belgium and Germany) for the production of zinc and sulphuric acid. (See also this J., 1919, 91 R.)

Chemical Industry and the Peace Treaty.—The official summary of the Treaty of Peace presented to Germany by the Associated Powers on May 7 at Versailles imposes certain obligations on that country in regard to the supply of various chemical products. "Germany accords option to the Inter-Allied Reparation Commission on dyestuffs and chemical drugs, including quinine, up to 50 per cent. of total stock in Germany at the time the Treaty comes into force, and similar option during each six months to end of 1924 up to 25 per cent. of previous month's output." "Germany is to deliver annually for 10 years to France coal equivalent to the difference between annual pre-war output of Nord and Pas de Calais mines and annual production during about 10 years." Germany is also to give options to France and Belgium for annual deliveries of 7 and 8 million tons of coal respectively. "Provision is also made for delivery to France over 3 years of benzol, coal tar and sulphate of ammonia. The Commission has powers to postpone or annul the above deliveries should they interfere unduly with industrial requirements of Germany."

The British Photographic Research Association.—This was the first Association to be founded under the scheme of the Department of Scientific and Industrial Research, having been incorporated in May 1918. Besides the president, Sir J. J. Thomson, and four vice-presidents it possesses a chairman and a council which, composed mainly of representatives of the twenty-three associated firms, includes also Dr. H. S. Allen, Prof. J. N. Collie and Sir Herbert Jackson. The director of research is Dr. R. E. Slade, and the laboratory is meanwhile at University College, London, but research work may be carried out elsewhere under his general direction.

Among the subjects proposed for purely scientific investigation (the results of which will be published from time to time) are: The fundamental properties of silver haloids; the physical and chemical properties of gelatin and other colloids; photochemical reactions; colloidal chemistry; the theory of colour photography. The subjects of applied research will include:—Desensitisation and reduction of sensitive materials, with particular reference to insensitive spots in plates and papers and to impurities in the raw materials; the causes of the specific effects produced by various samples of gelatin with a view to the improvement and ultimate standardisation of this product; apparatus and its material, including enamels, alloys, etc.; paper and cardboard; colour photography. The Association will maintain its active interest in any result achieved in technical research until this result has been adopted on a practical manufacturing scale. Under necessary restrictions and subject to the approval of the Council, specific researches may be undertaken for individual members.

A library has been founded, relevant scientific

literature will be collated and technical inquiries from members will be welcomed. The address of the Association is: Sicilian House, Southampton Row, London, W.C. 1. Secretary: Mr. A. C. Brookes.

Protection of Oil Tanks against Lightning.—The problem of the protection of petroleum products contained in tanks and reservoirs against lightning has been one on which the most divergent views have been held, and the Petroleum Executive is to be congratulated on its initiative in publishing a bulletin which enables those interested to obtain the views of experienced men on this subject. Although theory suggests that lightning conductors should prove of great service, practical men have decided that efficient theoretical protection not only adds to the expense of construction, but is a real source of danger owing to the liability of sparking taking place between the lightning rods and the steel structure of the tank or reservoir. The general opinion is that the tanks act as efficient lightning conductors, and in the majority of cases the view is expressed that the angular portions of the framework and of the handrailing round the top of the tank should be slightly lengthened and pointed in order to efficiently carry off brush discharge. Sir Oliver Lodge emphasises the fact that he could not recommend the attachment of any lightning conductors to tanks or reservoirs containing petroleum products, but in opposition to the major consensus of opinion he would prefer the steel structure not to convey electric current at all, and to obviate this he would avoid angular points on the top of the tanks and make no provision for efficient earthing of the tanks with the ground. As the result of many inquiries and considerations, it may be stated fairly definitely that in order to protect storage tanks from lightning to the best advantage, the tanks should be provided with a large number of points and edges along the top, capable of effectually dispersing an induced electric charge; that there should be no resistance between the tank and the earth, and if built on a concrete foundation or on dry soil provision should be made for efficient earthing by means of copper conductors and earth plates. The recommendation of Sir Oliver Lodge that vent pipes from which gases are likely to escape should be surrounded with a metal cage efficiently connected with the pipe is worthy of general introduction.—(*Inquiry into the Protection of Oil Storage Tanks against Lightning. With a memorandum by Sir O. Lodge. Bulletin No. 1. H.M. Petroleum Executive, H.M. Stationery Office, 2d.*)

Dutch Margarine and Butter Industry.—Before the war the annual production amounted to about 30,000 tons butter and 100,000 tons margarine; 30,000 tons of the latter was for home consumption, and 60,000 tons went to England. The margarine industry was able to develop to such a degree because cheap raw material was available from America and sufficient milk was produced at home. The adulteration of butter was practised, particularly in North Brabant. The butter from that quarter usually had a high Reichart-Meissl value, as the makers mixed margarine with it so as to be within the lowest R-M. value allowed and sold the mixture as pure butter. This adulteration proved detrimental to the farmers and Dutch butter no longer commanded a high price on the market. Besides margarine, the Dutch Board of Agriculture permitted mixtures containing 35 or 65 per cent. butter and 65 or 35 per cent. margarine to be supplied in Holland.—(*Chem. Umschau*, No. 12, 1919.)

New Kaolin Deposits in Norway.—New strata of kaolin have been discovered in the island of Bornholm. Preliminary investigations indicate that the deposits are rich and that the quality is of the very best.—(*Berlingske Tidende, Mar.* 20, 1919.)

Industrial Uses of Seaweed.—A factory has been built in Norway for the manufacture of "Norgin" and "Tangin" on a large scale from seaweed. The former substance is similar to size, and is used as dressings for cotton and linen fabrics and by painters for the preparation of inside walls and ceilings. It is soluble in cold water, and therefore more easily applied than ordinary size. It is also used in the manufacture of soap, buttons, india-rubber hose pipes, oil paper and imitation leather. "Tangin" is a powder with special medicinal properties for use in bath-water and is recommended by the medical faculty. The seaweed undergoes a special treatment immediately after collection to prevent premature decay. The thick stalks, which are especially valuable, are barked, sliced, pressed and subjected to various chemical processes before the products are complete.—(*Teknisk Ukeblad, Mar.* 21, 1919.)

Neutral Palm Oil.—At a meeting of the Academie d'Agriculture, M. Lindet gave a *résumé* of a paper on neutral palm oil by M. Paul Ammann, director of the laboratories at the Ecole Coloniale de Nogent. It is known that palm oils always show a marked rancidity, indicated by a high acidity and disagreeable odour; this rancidity is due to the splitting of the fat by enzymes present in the vegetable tissue during the period when the fruit is subjected to excessive ripening (in order that it may easily be detached from the cones), and during the prolonged treatment of the fruit in pits or in vessels so that they may more easily give up their oil when cooked. M. Paul Ammann explains that the cones can be detached before they are completely ripe and cooked immediately in water; by this means the fruit can be just as easily detached, and the acidity of the oil produced does not exceed 0·2 per cent. as compared with 14—15 per cent. frequently met with. These neutral oils can be used for edible purposes.—(*Depêche Col., Feb.* 18, 1919.)

Mining Situation in Granada, Spain.—The acting British Consul at Malaga reports that, with the following exceptions, mining operations have been nearly at a standstill:—During the past year a Belgian company raised 5000 tons of lead ore: three British firms mined about 565,000 tons of iron ore; the mercury and calamine outputs were only 1774 kilo. and 90 tons respectively; 400 tons of wolframite was extracted by a Parisian company. Quite recently (1919) a newly-formed company has been exploiting the wolfram deposit with considerable success.

The province contains some rich and extensive deposits of iron, lead, copper and zinc ores; also lignite and some asbestos, but in every case exploitation is left to foreigners, the Spanish, and especially the Andalusians, being very lacking in enterprise. It is reported that a company is about to commence the mining and distillation of lignite.—(*Bd. of Trade J., Mar.* 13, 1919.)

Mineral Wealth of Austria-Hungary.—The *Deutsche Allgemeine Zeitung* publishes an abstract from a book by Dr. Tertsch, of Vienna, on the mineral wealth of the former Austro-Hungarian Empire.

In German Bohemia the rich deposits of wolfram and radium, and the graphite mines in Southern Bohemia, would be invaluable to German industry. German Austria is rich in iron and does not lack graphite for the iron industry. The molybdenum and quicksilver mines will doubtless come into the possession of the Slovenes. Should the Czechs retain Slovakia and the Rumanians Transylvania, the future Magyar State will contain practically no mineral wealth, whereas Rumania

will become a rich land. Austria was completely independent of foreign supplies of iron, antimony, mercury and radium, and was practically independent of imported lead. The country depended to a considerable extent upon foreign sources of zinc and silver, and the home production of copper, tin, bismuth, arsenic and platinum was less than 10 per cent. of the total requirements. In the years 1910-13 the total consumption of metals in Austria-Hungary was 24,734,370 tons, valued at 339 million kroner.—(*Bd. of Trade J., April* 3, 1919.)

Metals Required for the German Steel Industry.—The supply of metals required for the German steel industry is the subject of a recent monograph by Beyschlag and Krusch (1918), who arrive at the conclusion that sufficient molybdenum and vanadium can be obtained from home sources, but nickel, chromium and tungsten must be imported from abroad.

In 1913 Germany consumed about 6000 tons of nickel and 100 tons of cobalt. About 500 tons of the former was obtained from the nickel-cobalt ores of Frankenstein, Schneeberg, St. Blasien and Sohland, and the remainder from New Caledonia and Canada, sources which must be tapped again after the war. All the chromium used has hitherto been imported. In 1913, 23,251 tons was obtained from New Caledonia, Rhodesia and Turkey. In the same year, 400—500 tons of tungsten was extracted from native ores, out of a total consumption of 4500 tons, the imported material coming from Spain, Portugal, Argentina, India, Australia, Malaya, and England. Prior to the war, molybdenum was used in Germany solely as a source of chemical preparations; only in the works at Teutschenthal was ferro-molybdenum produced for export to England. The best native source is the Mansfeld copper schists, which contain 5 per cent. of molybdenum ore; and the wulfenite deposit at Werdenfels in Höllental near Garmisch still awaits exploitation. The total home demand could be met by the vigorous working of the native copper schists.

The demand for vanadium was very small before 1914: to-day it is from 600—800 kilo. per month. German South-West Africa (Otavi) formerly supplied 60—150 tons of mottremite, containing 8—10 per cent. of vanadium. Iron ores and clays have a small vanadium content, and slags show 0·5—0·7 per cent. vanadium; the copper schists also contain this metal. Foreign sources of supply are Colorado, Utah, Pennsylvania, New Mexico (Siena de los Cabellos), and Peru (Mina Rapros). In 1911 the last-named produced 2151 tons of ore, equal to three-fourths of the world's production. The German demand will probably be about 18 tons, and this should be obtained by recovery from slags.

The authors advise the accumulation of a reserve of the above metals, sufficient to last 5 years, which could be used instead of gold for covering the issue of paper currency. The State should acquire (metric tons):—nickel 20,000, chrome ore 150,000, wolframite 10,000, molybdenum 750, and vanadium 45. These would have a total value of 341·75 million marks (about £17,000,000.)—(*Metall u. Erz, Feb.* 8, 1919.)

Future of the German Nitrogen Industry.—Negotiations have taken place between the German Imperial Economic Office (Reichswirtschaftsamt), the Imperial Treasury and the representatives of the nitrogen industry for the purpose of founding a State nitrogen monopoly. These have now been concluded, and as a result it is proposed to establish a State Syndicate of the Nitrogen Industry, similar to the potash syndicate, with a compulsory number of shares, but not interfering with the independence of the individual enterprises.—(*Bd. of Trade J., May* 8, 1919.)

German Potash Industry.—Conditions of production were discussed at a recent meeting of representatives of the German Potash Syndicate. It was pointed out that the restriction of output gravely prejudiced the immediate future of agriculture and that the effects would be specially marked in this year's potato crop. Spring manuring has been almost wholly omitted, and the autumn manuring was uncertain. Owing to the stoppage of sales from November 1918, the year's output of potash had been only 1,020,000 instead of the expected 1,200,000 metric tons as against 1,094,000 tons in the preceding year; and lack of coal consequent on the wagon position had made impossible the accumulation of reserves. The workers returning in large numbers from the front could therefore be employed only on unproductive work. The higher wages payable for a shorter working day with a reduced output, together with the enormous rise in the price of materials, had increased the cost of production so much that even with sales at the advanced prices fixed in July 1918 the works would have to close down. Orders for 140,000 wagon-loads of potash for German agriculture were already in arrear. A later review of the industry emphasises the necessity for a check in the race between the mounting prices of food and labour and expresses great satisfaction that negotiations have been entered into at Spa for the resumption of exports to America.—(*Z. angew. Chem., Feb.* 14, *Mar.* 18, 1919.)

The Linoleum Industry in Germany.—The German linoleum industry has been almost completely inactive during the war, and in trade circles the outlook is pessimistic, for although the demand for linoleum is very great neither makers nor dealers have stocks, and it is considered unlikely that the manufacture can be resumed before the end of the year. Jute and cork might, at need, be replaced, *e.g.*, by paper, but there is no substitute for linseed oil, and that will be required by the margarine factories for a long time to come. To import linseed oil for making linoleum, even if it were possible, is out of the question owing to the cost.—(*Z. angew. Chem., Feb.* 18, 1919.)

Union of German Technologists.—At a meeting held at Eisenach on February 8 and 9, 1919, the recently formed "Union of Technologists" (*cf.* this J., 1919, 126 R) adopted a constitution and rules. Reports from all parts of the country on the campaign for the more active participation of technical experts in administrative and political life indicated that the greatest success had been attained in Würtemberg, where all technical questions arising in the Chamber must be referred to a technical commission. The committee was empowered to arrange for the publication of a daily newspaper devoted to the interests of technologists. A resolution, addressed to the National Assembly at Weimar, stated that as technical workers were indispensable to the reconstruction of national and industrial life, they were entitled to participate in all decisions affecting the welfare of the State.—(*Z. angew. Chem., Feb.* 21, 1919.)

Mineral Wealth of the S.W. African Protectorate.—Diamonds constitute the most valuable mineral product of this former German colony. They were discovered in 1908, but are now nearing exhaustion. They occur in a coastal strip of gravel which does not extend more than 15 miles inland. The yield for 1913 was 1,284,727 carats, worth £2,698,500, which was over 20 per cent. of the world's output, whilst in 1914, up to August, 5,400,000 carats, valued at £9,250,000, had been gathered. In quality the diamonds resemble

Brazilian stones; they are small, but the size increases from north to south. The largest stone weighed 34½ carats, the average is from a fifth to a sixth of a carat. The diamantiferous gravel varies from 4 in. to 30 ft. in thickness, and the richest holdings have yielded 200 carats per cubic metre at a working cost of 2*s.* 2*d.* per carat. The industry has been Government controlled since 1900, and the Koloniale Bergbau Gesellschaft distributed during 1910—1913 dividends amounting to 112 times its capital of £5025. The highest dividend was 3800 per cent. A recent development of the diamond industry is the formation of a powerful company to dredge the ocean bed along the coast and the diamantiferous deposits of the shore. The existence of a large diamond pipe has been known for some years. The Government takes 40 per cent. of the proceeds.

Copper appears to be an increasingly productive industry; the chief deposits are in the Otavi district; other areas are Khan and Ida in the Swakopmund, and Sinclair in the Luderitz Bay districts. Exports in 1913 were worth £396,000.

The internal trade has been insignificant; the towns and villages are few; only in Windhoek do the European residents exceed 2000. The Germans have discouraged foreign interests and immigrants; there are natural barriers to the Protectorate by land and by sea, as the ports are unfavourable. Exports were diamonds and copper, and profits were external; but development of the copper industry may now give rise to a population with local demands that will stimulate internal trade. German money was, however, being invested in South-West African farms. Little more than 1 per cent. of the trade crossed the land frontiers, but with present railway facilities land trade may be expected to develop. In spite of German exclusiveness the Protectorate has not been a financial success, and with the waning diamond industry the outlook was not promising.—(*Bd. of Trade J., April* 3, 1919.)

New Manganese Ore Deposits in Panama.—H.M. Consul at Colon reports that new "bedded" and outcropping deposits of manganese ore have been discovered near Boqueron in the valley of the Chagres River. Part of the ore is broken up in boulders weighing as much as 150 tons. At two mines already started 30—40,000 tons of surface ore is in sight. Finer ores, which are bedded in clay, can be concentrated at a very small cost. At present there are two routes by which these properties may be reached, and it is probable that a railway will be built to Nombre de Dios, 8 miles away. The Boqueron River can produce adequate water power for contemplated operations.—(*Bd. of Trade J., April* 24, 1919.)

Mineral Resources of Guatemala.—Prospecting presents unusual difficulties in Guatemala because of the thick vegetation in some places and the heavy capping of volcanic ash in others. It is believed, however, that with improved shipping facilities the exploitation of a number of minerals would be commercially feasible. There is a large area in Guatemala where gold is known to exist in small quantities. Two companies are at present working this field, but operations have been hampered by war conditions. There are no silver mines in operation in Guatemala, but some were formerly worked at Huehuetenango and Chiquimula, and there are several localities which could be exploited advantageously. Lead deposits are fairly numerous, principally in the north-western districts, the ore carrying a low silver value. One small company at present mines lead, chiefly for local consumption.

Zinc is found in several places, but chiefly in Chiquimula, where it is generally associated with lead and some copper. Some of the concentrates were exported during the war when high prices prevailed. Traces of copper are found in various districts, but there are no deposits of sufficient importance to warrant commercial development.

The iron ore deposits of Guatemala, though of high grade, are of little importance. The chrome ore fields are said to be quite promising, high grade deposits having been found in several districts. About 2000 tons of ore was exported during 1918. Limestone is found in large quantities and is used in conjunction with a siliceous volcanic ash for making cement. Coal deposits have been found but require further investigation. Graphite also occurs.

A large quantity of mica has been exported to the United States during the war, and efforts are being made to continue the working of the mines. A good grade marble is found in quantity. Nitre and sulphur are worked by the Indians to supply local needs.

Titanium, mercury, antimony, and molybdenum are all known to exist in Guatemala, but no efforts are being made to exploit them.—(*U.S. Com. Rep., Jan.* 31, 1919.)

Secondary Metals in 1917.—A report by J. P. Dunlop treats of the efforts made in the United States to utilise metalliferous waste of all descriptions in place of new or primary metal, and gives details of the classification and treatment of copper, lead, zinc, antimony, tin, aluminium and nickel. The author mentions that the value of the British Army salvage for three years was estimated at $500,000,000, out of material which formerly went into the scrap heap. The price of steel from the open-hearth furnaces remained practically the same on account of the use of cheap steel scrap. By the use of the naval gun factory of its own scrap, the U.S. Government was saved $308,775 in 1917. To use the scrap to the best advantage a series of specifications were drawn up whereby the materials were classified as regards size and purity. The Eastern Brass and Ingot Corporation established several plants for briquetting machine turnings for manufacturers, adopting enormous pressures with a sharp shock in such a manner as to expel the air before the shock is delivered, thus preventing the disintegration of the ingot when fed into a hot crucible, and also effecting a reduction of about 80 per cent. in losses by oxidation. Apart from tin, the methods used for the re-smelting of the non-ferrous metals are much the same as those adopted for new metal, except that the fluxes used have to be carefully chosen in order to avoid excessive losses by oxidation.

The secondary tin recovered in 1917 amounted to about one-fourth of that imported, and was valued at about $24,000,000. The tin-plate scrap is detinned by one of three processes—the electrolytic alkali, the chlorine, or the alkali saltpetre process. The first yields spongy tin for re-smelting, the second tin tetrachloride for the silk industry, and the third tin oxide. The total recovery from this source was 3330 tons (representing about 27 to 32 lb. of tin per ton), or about one-ninth of the amount used in 1917 for this purpose. The plants established have not been working to their full capacity, as beyond a certain radius the shipment costs render treatment unprofitable. A great economy in tin has been effected by the less extravagant use of the metal in solders and bearing metals, and some useful proved formulæ are given in which the percentage of tin is greatly curtailed without loss of efficiency.

The statistics quoted show fully that the secondary metals have as much claim to the manufacturer's attention as the primary metals, and upon their economical use depends much of the future prosperity of manufacturing organisations.—(*U.S. Geol. Surv., Feb.*, 1919.)

PERSONALIA.

Prof. F. Soddy, professor of chemistry in the University of Aberdeen, has been elected to the newly established second chair of chemistry in the University of Oxford.

The Poynting Chair of Physics in the University of Birmingham has been filled by the appointment of Dr. S. W. J. Smith, assistant professor at the Imperial College, South Kensington.

The death is announced of Prof. J. J. T. Schloesing, the well-known agricultural chemist, at the advanced age of ninety-four.

Dr. A. A. Boon, who has been on the teaching staff since 1898, has been appointed professor of chemistry at the Heriot-Watt College, Edinburgh. Dr. Briggs, head of the department of mining in the same College, has been promoted to the status of a professor.

Mr. W. A. Walmsley, manager of the Clayton Works of Messrs. Hardman and Holden, Manchester, has been appointed chemist to the Corporation of Glasgow to superintend the distillation of tar, ammoniacal liquors, etc.

The widow of the late Col. Bertram Hopkinson, professor of mechanism and applied mechanics at Cambridge University, has offered £2000 towards the endowment of a new chair in the same university to be called the Hopkinson Chair of Thermodynamics. Further sums amounting to £1750 have been promised by others.

The delayed list of "New Year's" Honours has now been published. A baronetcy of the United Kingdom has been conferred on Mr. Charles Greenway, chairman and managing director of the Anglo-Persian Oil Co., Ltd., and immediate past-president of the Institution of Petroleum Technologists. The honour of knighthood has been conferred upon Mr. W. S. Glyn-Jones, Secretary and Registrar of the Pharmaceutical Society; and upon Prof. R. A. Gregory, for many years acting-editor of *Nature* and organiser of the British Scientific Products Exhibition held last year.

REPORT.

THE PRODUCTION OF OIL FROM CANNEL COAL AND ALLIED MINERALS.

The special committee appointed by the Institution of Petroleum Technologists has now presented its final report. As the outcome of the interim report issued in August last (this J., 1918, 326 R), a company has been formed to produce oil from bituminous material, to manufacture domestic and industrial fuel, and cognate objects. The company is styled the Midland Coal Products Co., Ltd., and has a capital of £100,000, which has been fully subscribed. A site has been chosen in the centre of the Midland coalfield which is adjacent to three shafts now bringing up various grades of coal, served by three railways, and generally well adapted for carrying out the operations mentioned in the Memorandum of Association. Large works are to be erected, but the company is not to confine its activities to the district in which these are situated. The undertaking is not in receipt of Government assistance, nor is it interested in any particular type of retort or process. The development of this industry has resulted in the production of various designs for new types of retorts, some of which are technically unsound, and it is anticipated that the company will be able to fulfil a very useful function in investigating new types of retorts, and in determining the most profitable use and method of treatment of any particular material, thus helping to establish the industry on a sound commercial basis.

PARLIAMENTARY NEWS.

HOUSE OF COMMONS.

Export of Bleaching Powder.

Sir Kingsley Wood asked whether the President of the Board of Trade was aware that German and Austrian bleaching powder is offered in the market at £11 10*s.* per ton delivered in Sweden; and that British manufacturers have been unable to ship freely to Sweden because of the time lost in obtaining guarantees from Sweden and export licences on this side; and if he would give an undertaking that these licensing restrictions and guarantees from neutral countries shall be abolished.

Mr. Bridgeman in reply said he had no information to enable him to reply to the first part of the question. There has in a few cases been some delay in the issue of licences for the export of bleaching powder to Sweden, owing to the necessity for obtaining guarantees against re-export, but an arrangement has been made with the Inter-Allied Trade Committee in Sweden that as soon as guarantees have been issued the numbers of such guarantees, with certain other particulars, should be telegraphed to the Export Licence Department, which will promptly issue the necessary licence without waiting for the actual guarantee. By this arrangement the delays complained of should to a great extent be removed.—(April 29.)

The Budget Statement.

One of the chief proposals for the new financial year is the initiation of a scheme of Imperial Preference, under which existing duties on manufactured articles and on consumable commodities, other than alcohol, coming from the Dominions will be reduced by one-sixth. The loss of revenue thereby entailed in respect of sugar will be about £500,000, only 7 per cent. of the imports of this material coming from Empire sources. The excise duty on beet sugar in this country will be reduced accordingly. The reduction in revenue on motor spirit, 18 per cent. of which is supplied by the Empire, will be about £60,000. The rate of preference on spirits will be 2*s.* 6*d.* a gallon, charged as extra duty on foreign spirits, and this will involve a loss of over £3,000,000 in a normal year. The income tax is to be left unchanged pending the report of the Royal Commission, the death duties to be increased, but the excess profits duty to be reduced from 80 per cent. to 40 per cent. The duty on proof spirit to be increased from 30*s.* to 50*s.* a gallon, and that on beer from 50*s.* to 70*s.* a standard barrel; the average gravity of the latter not to exceed 1040 (existing limit 1032).—(April 30.)

Fertilisers.

In answer to Capt. Terrell, Mr. Kellaway stated that there is no shortage of nitrate for use on the land. The Ministry of Munitions is ready and willing to dispose of its stocks of nitrates, but there is at present no appreciable demand from farmers in this country. The price is fixed by the Board of Agriculture at £20 a ton.

The same member asked the Parliamentary Secretary to the Board of Agriculture what steps were being taken to lower the price and increase the supplies of fertilisers. Commander Eyres-Monsell replied that the prices of artificial fertilisers have been fixed by Orders issued by the Ministry of Munitions up to May 31, 1919. In the cases of sulphate of ammonia and superphosphate the prices fixed were less than the cost of production. Active steps have been taken to increase the quantity available for agriculture, and in consequence this has been larger than in any previous

year. It is not proposed to continue the fixing of prices by Order during the coming season, but the Board is endeavouring to arrange by voluntary agreements among the makers that fertilisers shall be sold at reasonable prices.—(May 1.)

German Munition Factories

Sir A. Steel-Maitland, in response to Sir K. Wood, intimated that the Ministry of Munitions arranged to send over at intervals representatives of various British industries. In all, four missions were to be sent, one of which was a Chemical Mission. This has already returned and reported with regard to poison gas manufacture, and has yet to furnish reports of other matters. It was felt, however, that a commission representing chemical manufacturers should also be sent with the object of studying German chemical manufactures from a commercial point of view, and arrangements for this were undertaken by the Department of Overseas Trade. Some delay has arisen because it was found difficult to make arrangements for parties of more than six or eight at a time, while the Association of British Chemical Manufacturers urged that the group of industries concerned could not be adequately represented by a party of less than twenty. A reply has, however, now been received from the Governor of Cologne that a commission not exceeding twenty members can be received at an early date, provided that not less than seven days' notice is given. The Association of British Chemical Manufacturers has been advised accordingly; arrangements are now being made, and the military authorities are anxious to co-operate in every way in their power.—(May 2.)

Benzol Supply.

Sir A. Geddes informed Mr. Joynson-Hicks that of the 1577 gas undertakings in the United Kingdom, 183 have installed oil-washing plants and 600 tar-washing plants for the production of benzol. The Board of Trade has no power to compel gas undertakings to provide themselves with such plant.—(May 5.)

British-America Nickel Corporation.

Replying to Mr. Hugh Edwards, Sir A. Geddes stated that H.M. Government is in a position, should occasion arise, to exercise complete control over the business of the British-America Nickel Corporation, but otherwise no conditions are imposed on the actual conduct of that business. The Government has appointed representatives to the directorate, and has advanced to the Corporation $3,000,000, which is secured by the issue of 6 per cent. mortgage 15-year gold bonds. The first repayment of $250,000 for the redemption of the bonds, due on February 1, 1919, has not been paid and the Corporation has been granted permission to postpone payment by H.M. Government, which has neither received nor asked for any compensation for this accommodation.—(May 5.)

LEGAL INTELLIGENCE.

Application for Use of Enemy Patents.—On April 23, before the Controller of Patents in the Patents Court, London, an application was made by Morton Sundour Fabrics, Ltd., of Carlisle, for licences to use certain patents of the German firm of Bayer & Co. for the manufacture of dyestuffs. The patents in question were Nos. 29138/09, 2373/09 and 25986/09. The firm had previously been granted licences in respect of other processes. The Controller intimated that the grant of the licences would be recommended.

TRADE NOTES.

BRITISH.

Mauritius in 1917.—The value of the total trade of the Colony in 1917 was 100,472,188 rupees (£6,698,145, with the rupee at 1*s.* 4*d.*), showing a decrease of about 21 per cent. below 1916, but a gain of 40 per cent. over 1913. The principal reductions in imports in 1917 were in respect of grain and flour, yarns and textiles, chemicals and drugs, and the chief increases, fertilisers, chemicals for local manufacture and tobacco. The exports included:—Sugar, 187,815 tons, valued at Rs. 54,539,232; aloe fibre, 1194 tons, at Rs. 411,600; coconut oil, 112,000 litres, at Rs. 62,500; molasses, Rs. 29,000; rum, Rs. 26,600; and vanilla, Rs. 4100.

The cost of production of sugar, in field and factory, has increased since 1914 by 55·4 per cent., while the increase in the average sale price is computed at 50 per cent. compared with the pre-war average. The total crop for 1916-17 was 209,035 tons, and that for 1917-18, 226,000 tons. The whole of the vesou crop of 1917 was sold to the Royal Sugar Commission on the basis of 17*s.* per cwt. f.o.b. for the first grade sugar, but subsequently arrangements were modified to allow of a portion of the vesou to be shipped to India, together with the whole of the first syrup sugar, for financing the export of foodstuffs and essential supplies to Mauritius. The cultivation of limes, for which the soil is well suited, is under consideration.—(*Col. Rep.—Ann., No.* 985, *Feb.*, 1919.)

The East Africa Protectorate in 1916-17.—The value of the goods exported from this Protectorate in 1917 was £587,014, and the values from the other territories serving the ports of Mombasa and Kilindini were: Uganda £699,824, German East Africa £47,118 (against £448,103 in 1914), Belgian Congo £279,670 (£26,127 in 1914), and the Sudan £197.

There was an increase of about 50 per cent. in the value of hides and skins exported from the Protectorate, 97 per cent. of the total exports going to the United Kingdom. Exports of sisal and "other sorts" increased by 38 per cent. in quantity and 69 per cent. in value over the previous year. The export of grain and oil seeds, while still only 27 per cent. of the quantity shipped five years ago, increased by 85 per cent. in quantity and 108 per cent. in value. The export of copra rose from 9774 cwt., valued at £8433, to 28,748 cwt., valued at £28,748; 23 per cent. of this export went to Britain, 31 per cent. to Italy, and 45 per cent. to France. The quantity of rubber exported increased from 500 to 1001 cwt. The export of sodium carbonate amounted to 2163 tons, valued at £45,056. Of this, 1771 tons was shipped to India, 212 tons to Egypt, 100 tons to Italy, and 51 tons to S. Africa.

Sisal cultivation is rapidly increasing as a result of the establishment of electric power stations, and the very high prices obtained for sisal fibre in England. The future of this industry is regarded as most promising, a number of factories being now established in various parts of the country, the local demand for the necessary machinery being very much in excess of the supply available.

The working of the soda deposits of Lake Magadi continues to be carried on successfully, and this industry will probably develop into one of the most important in the Protectorate.

The position as regards mica remains much as it was in the previous year, the effect of the war having been to cause good prices to obtain in the home-markets, but at the same time to cut off the supply of skilled European supervision necessary to the successful working of the concessions.—(*Col. Rep.—Ann., No.* 988, *Mar.*, 1919.)

FOREIGN.

The Spanish Olive Oil Crop.—The following figures, based upon general opinion rather than definite statistics, stand for the whole of Spain, but really represent the production of Andalusia, where practically all the oil is manufactured.

The estimate for 1917-18 is 460,000 metric tons, including the hold-over from the previous year. About 23,000 metric tons was exported in 1918, and 230,000 tons consumed, leaving a balance on hand of 207,000 tons. The 1918-19 crop will be only about 230,000 metric tons: this added to the stock on hand gives 437,000 tons; the annual Spanish consumption is 230,000 tons, consequently 207,000 metric tons remain for export. Probably the Government will authorise the export of only 115,500 tons during 1919. Large exports will necessitate large supplies of barrel staves and tinplate for containers.

Practically the whole of the oil is owned by Spanish subjects and a recently appointed royal committee regulates commerce. The committee will strive to harmonise the interests of the producers and consumers of olive oil including the utilisers of by-products, such as greases and fuel.

Olive oil is an important source of Spanish income, and owing to rise of price export has been restricted. The 1918 export was only one-third of that of the two previous years.—(*U.S. Com. Rep., Mar.* 3, 1919.)

Swedish Wood-Pulp Market.—Shipments of wood-pulp from Sweden to Germany have been resumed. Large shipments from Göteborg to France and England have nearly exhausted the stocks. Price: 300 to 315 kronor per metric ton (2*d*. per lb.) f.o.b. Göteborg (kronor = 1*s*. 1½*d*.). Demand for sulphite pulp has been weakened owing to the British paper controller having taken over, as from January 1, 1919, all purchases and shipments, but the demand is expected to increase when English paper manufacturers are given new import licences. The present production of sulphite pulp is about two-thirds of the normal, and stocks are about 90,000 tons less than a year ago.

Increased manufacturing expenses have enhanced prices, which are now 425 to 430 kr. per metric ton f.o.b. Göteborg for bleachable sulphite, and 400 to 405 kr. for strong sulphite. F.o.b. prices at Gulf of Bothnia are 40 kr. lower owing to freight difference; and these are 20 to 30 kr. lower than Norwegian prices.

The sulphite cellulose market has been dull since the stoppage of the manufacture of spinning paper, export of which to the Central Powers has been prohibited. In spite of greatly increased manufacturing expenses, selling prices have not been increased, and are now 370 kr. per ton f.o.b. Göteborg, and 340 kr. per ton f.o.b. the Baltic. The above prices relate to December 1918.—(*U.S. Com. Rep., Mar.* 11, 1919.)

Position of the Soda Industry in Switzerland.—A recent decree of the Bundesrat runs: "Anyone wishing to manufacture or import into Switzerland products of soda, or mixtures of which it is the chief constituent, requires a permit from the Bund. The permits are limited as regards time and quantity and may be renewed or withdrawn. The Bundesrat will attach to these permits such conditions as may serve to secure home requirements at moderate prices." In a report to the Neutral Commission the Bundesrat points out that the restricted import of coal consequent on the armistice has completely altered the favourable position of the Swiss soda industry, which will have to be temporarily suspended. The Solvay company offers soda ash at 25—30 francs per 100 kilo. delivered in Switzerland, whilst the Swiss product now costs 66·2 francs. In order to preserve its industrial independence as regards raw materials and to protect the home soda industry, the Bundesrat has decided against a soda monopoly and against dealing with the competition between the home and foreign industries either by tariffs or friendly agreements. The embargo on alkalis of November 19, 1917, will not be enforced and the manufacture and export are freed.—(*Z. angew. Chem., Mar.* 18, 1919.)

Impending Resumption of Trade Relations between Germany and Japan.—According to the Bâle *Anzeiger*, a Japanese Commission recently left Tokyo for Italy, charged with the duty of making a trade compact with Austria, Hungary and Germany. Reuter's correspondent states that Japan will send finished goods and raw materials, principally copper, to Germany, and that she expects to receive in return chemicals and electrical goods.—(*Oester. Chem.-Z., Mar.* 15, 1919.)

GOVERNMENT ORDERS AND NOTICES.

EXPORTS.

Existing export prohibitions have been further relaxed, as follows:—

Headings transferred from one list to another.

From List A to List C:—

Aceto-celluloses; glucose, liquid; wood and timber of all kinds, hewn, sawn or split (except lignum vitæ, mahogany and hardwoods, which are on List C.)—(April 24.)

Iron ingots, plates and sheets, and sectional and constructional material of iron; steel containing tungsten or molybdenum; steel containing chromium, cobalt, nickel, or vanadium; steel, sectional and constructional material.—(May 1.)

From List B to List C:—

Bauxite.—(April 24.) Milk powder.—(May 1.)

Altered headings.

(A) Oils and fats, edible, including blends of two or more edible oils and fats, except the following (which are on List C): Hempseed oil, kapok seed oil, maize oil, mowrah seed oil, niger seed oil, olive oil, poppy seed oil, rape seed oil, shea butter, sunflower oil, dripping, premier jus.—(April 24.)

Export Licences.—The Board of Trade announces that all licences will now be accepted by the Customs Department irrespective of any time limit which they may contain.

Salt of all kinds may now be exported to Norway without licence or guarantee.

An open general licence has been issued allowing of the exportation of lactol and lactogol to all destinations except those referred to in List C.

Exports to Occupied Areas.—The general licence issued by the Board of Trade authorising, on certain conditions, the supply of goods to the occupied territories on the left bank of the Rhine, has been extended to apply to the right bank also.

The Statutory List.—The Foreign Office has notified that as from midnight, April 28-29, all Black Lists were withdrawn; there are therefore no disabilities attaching to trade and communication with firms or persons on these lists.

IMPORTS.

The importation, except under licence, of the following articles is prohibited:—Potash salts, namely, potassium carbonate, bicarbonate, chlorate, perchlorate, chloride or muriate, chromate and bichromate, cyanide, ferrocyanide or yellow prussiate, hydrate or caustic, nitrate, permanganate,

sulphate, including potash alums and potash manurial salts and mixtures containing any of these substances; saccharin and mixtures containing saccharin and other substances of like nature and use.

Restrictions on the importation of the following articles, *inter alia*, have been removed :—Yeast; antimony, crude, regulus and sulphide; waste or scrap rubber.

The importation of the following is to be licensed only exceptionally, as and when required :—Methyl alcohol; scientific glassware (for full list of articles included under this heading *v. Bd. of Trade J.*, May 8, 1919).

The importation of the following is to be restricted :—Glassware (including bottles and jars) other than scientific glass and glassware, machinery glass and glassware, optical glass and manufactures thereof, miners' lamp glasses and miners' electric lamps, are to be admitted at the rate of 50 per cent. of 1913 imports.

Dyes.—The Trade and Licensing Committee has issued a general licence authorising the importation of dyestuffs and other products covered by the Prohibition of Import (No. 29) Proclamation (this J., 1919, 94 R), which are of ***bonâ fide*** Dominion origin.

Paper.—The Paper Control has been abolished as from April 30. On that date the Board of Trade issued a memorandum concerning the regulations now to be enforced with regard to the importation of paper and paper goods. Importations of paper manufactured within the British Empire are free of licence, but those from foreign countries are prohibited except under licence. The conditions under which licences will be issued are set out in the *Board of Trade Journal* of May 8.

NEW ORDERS.

The Gas Works Retort Carbon, etc., Control (Suspension) Order, 1919. Ministry of Munitions, April 18.

The Seeds, Oils and Fats (Suspension) Order, 1919. Ministry of Munitions, April 29.

The Steel and Iron Supplies Control (General Suspension) Order, 1919. Ministry of Munitions, April 29. [The Schedule to the Order contains a list of 14 Orders which are suspended as from May 1, until further notice.]

The Food Controller has issued a new Order fixing maximum prices for copra, ground nuts and palm kernels, and the resultant crude and refined oils obtained therefrom.

NOTICES.

The Food Controller has issued a Notice revoking the following Orders :—The Oil Splitting Order, 1917; The Oils, Oilcakes and Meals (Requisition) Order, 1917; The Hardened Fat (Requisition) Order, 1917; The Seeds, Nuts and Kernels (Requisition) Order, 1917; The Oils and Fats (Requisition) Order, 1917; The Home Tallow and Greases (Maximum Prices) Order, 1918; The Bones (Maximum Prices) Order, 1918; and The Edible Oils (Maximum Prices) Order, 1919.

Seeds, Nuts, Kernels, Oils and Fats.—The Minister of Munitions has given notice that he has issued a general licence authorising all persons to deal in any of the seeds, nuts and kernels, oils and fats scheduled to the Orders made by the Minister of Munitions on May 1 and 9, 1917. As the operation of the various Seeds, Oils and Fats Orders of 1917 has been suspended (*v.s.*), he will in future exercise no control whatever over any of the materials referred to in these Orders.

The Board of Trade has announced (April 26) that, with a few exceptions, all controls on the sale and distribution of commodities exercised under the Defence of the Realm Act have been, or will be, abolished by May 31 at latest.

OFFICIAL TRADE INTELLIGENCE.

(From the Board of Trade Journal for April 24 and May 1.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 73, Basinghall Street, London, E.C. 2, from firms, agents or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

Locality of Firm or Agent	Materials	Reference Numbers
Canada	Preserved foods, sugar, syrup, cocoa butter, gelatin	753
,, ...	Chemicals, medicines, soap	755
,, ...	Chemicals, laboratory equipment, scientific instruments	756
,, ...	Chemicals, perfumes ..	*
Mauritius ..	Linseed oil, paints, turpentine, putty, glass, paving tiles	726
New Zealand ..	Soap	757A
South Africa ..	Glass bottles, leather ..	704
,, ..	Superphosphates, fertilisers	766, 767
,, ..	Chemicals, drugs, perfumery	768
,, ..	Phosphate fertilisers ..	177/3/19†
Belgium ..	Chemicals, drugs, varnish, paints	777
,, ..	Soap	780
,, ..	Fertilisers (sulphates and nitrates)	781
,, ..	Oils and greases ..	782
,, ..	Metals, glass, enamel ..	784
,, ..	Dyes, varnish, spirits, driers	785
,, ..	Glass, earthenware ..	787
,, ..	Asphalt, fertilisers, colours, varnish ..	2587 T & R‡
,, Netherlands	Fruit essences and colours for confectionery and mineral waters ..	789
France	Glassware, fertilisers ..	733
,, ...	Chemicals for tanning and dyeing sheepskins ..	795
,, ...	Metallurgical products ..	796
,, (W. Africa)	Rice and maize starch ..	735
Copenhagen ..	Fats and oils for the margarine industry ..	740
,, ..	Writing and lithographic paper	741
,, ..	Iron, steel, metals ..	728
Italy	Pig iron, vulcanised fibre	800
,, ...	Heavy and fine chemicals	802
,, ...	Pottery, glass	804
Sicily	Sodium nitrate, ammonium sulphate	808
Greece	Boiled oil, paint ..	736
Scandinavia ..	Soap, perfumes	807
Jugo Slavia ..	Chemicals	805
Spain	Iron, steel, copper sulphate, caustic soda ..	744
,, ...	Tin, tinplate, copper sulphate	745
,, ...	Chemicals, dyes ..	746
,, ...	Fertilisers	811
Switzerland ..	Chemicals and pharmaceutical products ..	749
,, ..	Skins, leather, glass, porcelain	750
Asia Minor ..	Metals, sheet copper, paints, oils, leather ..	773
Argentina ..	Galvanised iron and wire	772

* Canadian Government Trade Commissioner, 73, Basinghall Street, E.C. 2.

† South African Government Trade Commissioner, 90, Cannon Street, E.C. 4.

‡ Belgian Section, Department of Overseas Trade, India House, Kingsway, W.C. 2.

TARIFF. CUSTOMS. EXCISE.

Australia.—The importation of goods from Belgium is permitted after April 30 only where the proportion of the value of enemy material or labour in such goods does not exceed 5 per cent.

Drawback of the full amount of the duty paid is now allowed, under certain conditions, on paper (with some exceptions) and pipe or roll gamboge.

The importation of dry foodstuffs (with some exceptions), confectionery, soap, metal and linoleum polishes and dry pharmaceutical preparations, when put up in containers made from tinplate, is now permitted.

Belgium.—An export tax of 100 francs per hectolitre of 100 degrees strength (Gay-Lussac), at 15° C., has been levied on alcohol.

Canada.—Individual licences are still required for the export to all destinations of gold and silver coin, bullion and bars, cinchona bark and products, quinine and its compounds, cocaine, opium, syrups, molasses and sugar.

China.—The new import tariff will come into force on a date to be notified later. The published duties have been fixed to represent 5 per cent. of the average values of imported goods during the five years 1912—1916. Among the articles mentioned in the schedule of duties are chemicals, medicines, dyes, pigments, oils, soap, gum, wax, varnish, glass, china, earthenware, leather, paper, matches, sugar, starch and metals. The full list is given in the *Board of Trade Journal* of May 1.

France (Morocco).—The export of castor oil seeds is now allowed to France, French Colonies, Allied and neutral countries.

Italy.—The Ministry of the Treasury has been empowered to prohibit for such period as may be considered necessary the import of foreign currency.

New Zealand.—Butyric aldehyde and cattle-dip "Kiltic," are now admitted free of import duty.

Nigeria.—The import duty on kerosene and all other lamp oils and fuel oils not otherwise specified is fixed at 2*d.* per gallon, with an additional charge of 25 per cent. on the amount of duty so leviable.

Serbia.—British traders who desire to learn the rate of Customs duty on any particular class of goods should apply to the Dept. of Overseas Trade.

Sweden.—The export prohibition has been withdrawn, as from April 11, on timber, iron and iron alloys (with some exceptions), some classes of paper, glassware, earthenware and some chemicals and colours.

Switzerland.—The authorisation of the Federal Council is required for the manufacture and import of caustic soda and sodium carbonate, whether pure or as the principal constituent of a mixture.

Among the articles the export of which is covered by general licence are talc, emery stones, asbestos, glass, chemical apparatus, essential oils, nicotine, glycerin, resins, glue, gelatin, gluten, putty, grease for lubricating purposes, candles, soap, incandescent mantles and liquid gum.

United States.—Cinchona bark and its products, quinine and its derivatives, have been removed from the export conservation list.

The Government Scheme for Assisting the Dye Industry.—The Board of Trade has given notice (May 10) that the Trade and Licensing Committee has nominated the following gentlemen as the Licensing Sub-Committee to deal with all questions relating to the administration of the Prohibition of Import (No. 29) Proclamation, 1919, in respect of dyes, etc :—Mr. W. E. Kay (Calico Printers' Association); Dr. A. Rée (Association of British Chemical Manufacturers); Mr. J. Turner (British Dyes); and Mr. Thorp Whitaker (Bradford Dyers' Association). The chairman is Lord Colwyn. The offices of the Licensing Sub-Committee are at Danlee Buildings, 53, Spring Gardens, Manchester.

REVIEWS.

Oils, Fats and Waxes. *By* P. J. Fryer *and* F. E. Weston. *Vol. II., Practical and Analytical. Pp.* 314. *(Cambridge: The University Press,* 1918.) *Price* 15*s. net.*

This volume is supplementary to and completes the earlier treatise on this subject by the same authors, and deals with the technique of the analytical processes on which the control and elucidation of technical problems connected with the manufacture and uses of oils, fats and waxes are largely based. It stands in good relationship to the earlier one in that the method of treatment has been kept to the same lines, so that reference is made easy.

The object of the work is, according to the authors, to present an account of the methods of analysis etc. employed in this field of work, in such a detailed and careful manner that these analyses may be conducted with that exactitude and care which in no field is more necessary. The words of the authors in the footnote to page 2 must be heartily endorsed, as by faulty technique and careless procedure not only can the most fallacious results be arrived at in dealing with fatty mixtures, but, as in the technical manufacture of edible products of this nature, the question of loss is of the highest moment, so also is the question of exactitude of determination of the nature of their products at all the various stages of their manufacture.

From the vast host of analytical methods available, the authors have made such a selection as is, in their judgment, necessary and sufficient to the end in view, and when the extraordinary multiplication of perfectly useless processes for the analysis of edible oils and fats etc. is considered, such an attempt at selection is of great value both to the analyst and also to the manufacturer who has to understand such analyses, if this selection be found to be the result of experience and judgment. The selection made is a thoroughly good one, and provides ample information and guidance to the worker in this field. No doubt the apparent appeal to the student which marks all the methods may jar somewhat on the more advanced worker, particularly those who, not having learnt under a careful teacher, are apt to consider themselves infallible, yet the cautions inculcated are by no means to be considered lightly and leave the impression that the authors themselves fully understand the paths in which they endeavour to lead others.

For this reason, there is the temptation to the reviewer to be ultra-critical, and attention may perhaps be drawn to one or two points which may possibly have been quite unintentionally left open to question.

For instance, it is not quite satisfactory to instruct the student to weigh out an exact weight of recently ignited sodium carbonate taken from a desiccator, on a clock glass, particularly when the standard solution to be prepared therewith is the basis of some of the most important determinations such as the saponification value.

Again (p. 118), the Polenske value is stated to have reference only to coconut and palm kernel fats and butterfat, but the advent of such a variety of palm fats in general from many different species renders this statement too narrow. In dealing with the question of "acidity," it would have been advisable to draw the attention of the student to the fact that with coconut and other palm fats the method of expression as percentages of lauric acid is more useful and correct in practice.

Further, the statement (p. 167) that the saponi-

fication value of fatty acids is to be performed in a similar manner to that employed in determining the "acid" value of fats is likely to lead to serious error in certain cases.

It is almost invidious to pick out such slight errors as the above when so much is excellent, but this very excellence, as has been said, calls for criticism.

The great mass of figures and data given are reliable and point to painstaking care in their compilation.

The work is divided into sections dealing with (1) The general methods of analysis and investigation, (2) The interpretation of the results obtained, and (3) A scheme for attacking the problem of identifying or characterising unknown oils or fats. The scope of the book covers not only edible oils and fats, but also deals with those generally used by the soapmaker, together with waxes, rosin, turpentine, etc.

Whilst intended primarily for the analyst, it must be taken in conjunction with the earlier volume, to which it forms a worthy addition, and therefore should be of interest also to those who are directly engaged with the more technical side of this subject. CECIL REVIS.

A SYSTEM OF PHYSICAL CHEMISTRY. *By* W. C. McC. LEWIS. *Second Edition in three volumes. Vol. I., Kinetic Theory. Pp.* 494; *Vol. II., Thermodynamics. Pp.* 403; *Vol. III., Quantum Theory. Pp.* 209. (*London: Longmans, Green and Co.* 1918-19.) *Net prices:* 15*s.*, 15*s.*, 7*s.* 6*d. per vol., respectively.*

It is distinctly gratifying to find that a second edition of this work has been called for after a period which must be regarded as very brief when one considers that the attention of chemists during the last four years has been almost exclusively directed to problems of a severely practical kind. The author could not well desire a more striking manifestation of the appreciation with which his exposition of the general principles of physical chemistry has been received. It may be possible that the many new scientific enterprises which have been forced upon the chemist under war conditions are to some extent directly responsible for the recognition of the fact that an adequate knowledge of this branch of chemistry has become an absolutely essential part of the equipment of the modern chemist, whether his activities are academic or industrial.

Prof. Lewis's work, which is intended for use as a general text-book, covers a great deal more ground than is traversed in elementary treatises on the subject. The addition of a third volume to the two which served to confine the subject matter of the first edition obviates the division of the second volume into two parts, and is in the author's opinion justified by the rapid development of the new ideas which are associated with the quantum hypothesis, the claims of which to separate treatment are based on its successful application to problems which the kinetic theory and thermodynamics alone are incapable of solving.

The prefatory chart which indicates the mode of subdivision of the subject matter in the separate volumes might possible suggest that considerations of convenience and utility had been sacrificed to the rigours of a system, but in point of fact there is no evidence of this in the actual arrangement which has much to be said in its favour.

The detailed treatment of the subject matter is characterised by thoroughness, lucidity of exposition and suggestive criticism. The reader is brought into contact with the results of recent research, and with the memoirs which are usually regarded as physico-chemical "classics" by the inclusion of extracts from original papers. At every point, the book conveys the expression that the author has kept in very close touch with the recent advances which have been made in this rapidly expanding branch of physical science. It might possibly be urged that the illustrative experimental data are not always the best available, but this is a minor blemish in what can only be described as an excellent piece of work.

New additions to Volume I. comprise an account of crystal structure on the basis of X-ray measurement, of various aspects of the colloidal state, of the dual theory of catalysis and of Langmuir's investigations relative to the mechanism of surface effects in heterogeneous systems. In Volume II. the chief attraction is the addition of a new chapter on osmotic pressure. In Volume III., which is unique in many ways, the physico-chemical applications of the principles of statistical mechanics are dealt with, and the necessity for modifying the fundamental concepts thereof by the introduction of new ideas, such as are involved in the quantum hypothesis, is clearly indicated. The author is however under no illusion with respect to the position of the new ideas and recognises that the position of the quantum theory is not yet satisfactorily defined, although the sum total of evidence in its favour is considerable.

The new edition differs from the old in an increase in the size of the page and in the changed character of the letterpress. One of the least satisfactory features of the first edition has thus been remedied by the publishers in the issue of the second.

H. M. DAWSON.

PUBLICATIONS RECEIVED.

BOILER CHEMISTRY AND FEED WATER SUPPLIES. *By* J. H. PAUL. *Pp.* 242. (*London: Longmans, Green and Co.* 1919.) *Price* 14*s.*

CATALOGUE OF LEWIS'S MEDICAL AND SCIENTIFIC CIRCULATING LIBRARY. *Including a classified index of subjects with the names of those authors who have treated upon them. New Edition (revised to the end of* 1917). *Pp.* 492. (*London: H. K. Lewis and Co., Ltd.* 1918.) *Price* 12*s.* 6*d.*

AT A GLANCE. TWELVE CONVERSION TABLES FOR INTERNATIONAL VALUES OF BRITISH, METRIC, AND RUSSIAN WEIGHTS, MEASURES, TEMPERATURES, AND DATES. *By* J. E. SLACK *and* A. DOREY. *Pp.* 75. (*London: The Technical Publishing Company, Ltd.* 1918.) *Price* 7*s.* 6*d.*

DESIGN OF CONCRETE MIXTURES. *By* D. A. ABRAMS. *Bulletin* 1. *Pp.* 20. (*Chicago: Structural Materials Research Laboratory, Lewis Institute. April,* 1919.)

PUBLICATIONS OF THE UNITED STATES GEOLOGICAL SURVEY. *Department of the Interior.* (*Washington: Government Printing Office.* 1919.)

QUICKSILVER IN 1917. *By* F. L. RANSOME. *With a Bibliography by* I. P. EVANS.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN ARIZONA IN 1917. *Mines Report. By* V. C. HEIKES.

SECOND REPORT ON COLLOID CHEMISTRY AND ITS GENERAL AND INDUSTRIAL APPLICATIONS. *British Association for the Advancement of Science.* 1918. *Pp.* 172. (*Published for the Department of Scientific and Industrial Research by H.M. Stationery Office.* 1919.) *Price* 1*s.* 6*d.*

A STUDY IN THE PERFORMANCE OF "NIGHT-GLASSES." *By* L. C. MARTIN. *Bulletin No.* 3. *Department of Scientific and Industrial Research.* 1919. *Pp.* 39. (*London: H.M. Stationery Office.* 1919.)

STATE *v.* PRIVATE ENTERPRISE IN CHEMICAL INDUSTRY.

There is a tendency in some quarters to assume that methods which have led to success in war-time will be equally successful in times of peace. The assumption by the State of the control of certain industries, such as food production and the manufacture of munitions of war, was undoubtedly rendered imperative by the extraordinary exigencies of the time, and the end attained bears witness to the efficacy of the means employed; but, *tempora mutantur,* and it does not follow that these means would be practicable, equitable or conducive to economic well-being under entirely different circumstances. The subject of State *v.* private management in its application to the explosives industry was treated in a lucid and convincing manner by Mr. R. G. Perry, chairman of the Association of British Chemical Manufacturers, in his evidence before the Coal Industry Commission on May 16 last. The advocates of State-ownership on that Commission, who were apparently pre-convinced that the solution of the problem of munitions supply was due solely to State enterprise, cannot have received his evidence with much gratification, but their dissatisfaction will not be shared by those who believe, with the witness, that State management, as we know it, fails in peace-time because it lacks foresight and initiative, and that its success in time of war depends very largely upon assistance received from private sources.

Mr. Perry stated that as chairman of Messrs. Chance and Hunt, Ltd., and as responsible manager of H.M. Factory, Oldbury, he had had practical experience of both private and State enterprise. Although TNT had been adopted by the War Office as a standard high explosive in case of war, when the time came it was found that no adequate provision had been made for its production in bulk, plant was non-existent, and there was apparently no War Office official able to specify the process or design the necessary plant. In December, 1914, the War Office entered into an agreement with Chance and Hunt, Ltd., by which that company placed the whole of its resources, material and personal, at the disposal of the Government for the erection and operation of a national factory to manufacture high explosives. The Government was not able to meet the agreed condition to provide specifications of the process to be employed, designs of plant, etc., until after the arrival of the American chemical engineer, Mr. K. B. Quinan, in January, 1915. The production of finished TNT was commenced at Oldbury 14 weeks after the cutting of the first sod, and before the end of 1915, 3000 tons had been produced. The *personnel* of the second national factory, Queensferry, was drawn mainly from scientific and business men and not from Government Departments; it was under Government control, and the producing stage was not reached until one year after constructional work was started. There are many reasons which may be urged to account for the greater length of time taken to secure production at Queensferry as against Oldbury, but the point is that the initial step taken to secure an adequate supply of high explosive was to utilise an existing firm of British manufacturers, which, with the full assistance of a Government Department, obtained results more quickly than were afterwards achieved.

Refuting evidence given by Sir L. Chiozza Money, the witness said that the initial work of building up an explosives industry commensurate with the vital needs of the forces was performed by the Department of Explosives Supply while it was under the ægis of the War Office. The success achieved was due as much to the private firms to which the Government Departments communicated their needs as to the co-ordinating work performed by the latter. The fact that the War Office was compelled to hand over to an entirely new Department—the Department of Explosives' Supplies—the responsibility of providing such a vital need of war as explosives was an argument against complete reliance upon the principle of placing productive operations solely in the charge of Public Departments not subject to periodic judgment by results, as is the case with private companies. Mr. Perry also controverted the evidence of Mr. Sidney Webb. There were no data to support the contention that sulphuric acid could be produced more cheaply at State factories than in private works. The best practice of British manufacturers was at least equal in efficiency and cost of production to the best results of competitors overseas. The sole reason of the small production before the war was lack of demand, due largely to the absence of a dye industry.

In the autumn of 1914 the War Office pursued the policy of purchasing sulphuric acid from America; no encouragement was given at that time to home producers to extend their plants or erect new ones; British producers and experts were not consulted; and in the result probably not more than 75 per cent. of the acid purchased reached its destination.

The early purchases of TNT in the United States were at the rate of over 4*s.* per lb.; the cost of production of the 50,000 tons supplied by the Oldbury factory was 14·4*d.* per lb., inclusive of all charges, capital and operating.

The State-owned factory at Langwith for the manufacture of ammonium perchlorate began production many months after the privately erected works of the United Alkali Co., although the latter was started three months later than the former. The increase in the production of ammonium nitrate from about 100 to 4000 tons per week was effected by the Department of Explosives Supply making known its needs to the manufacturers, who overcame the difficulties presented, devised new processes, and, by extending their own organisations, achieved results that at one time appeared impossible.

PRODUCTION OF GLYCERIN FROM MOLASSES.

ARTHUR R. LING.

In view of the apparent close structural relationship between the monohexoses, glucose, fructose, etc., and glycerin, the conclusion seems justified that it ought to be possible to obtain the latter compound by the fermentation of these sugars under certain conditions with one of the saccharomycetes or yeasts. Nor is this mere speculation, for be it remembered that Pasteur in 1858 observed that glycerin and succinic acid, albeit in traces only, are invariable products of the so-called alcoholic fermentation of the sugars, and this is now a well-established fact. Moreover, there is every reason to believe that the glycerin at all events formed in this way owes its origin directly to the sugars and not to the secondary constituents always present in those fermentable liquids, worts, musts etc. met with in commerce. In this connexion it may be pointed out that F. Ehrlich showed in 1907 that the higher alcohols and esters present in fermented worts and musts are derived from the amino acids and not from the sugars. In 1909 he brought forward evidence that succinic acid is formed in the same manner.

Despite numerous attempts to obtain glycerin in such quantity by the fermentation of sugars that its production in this way would become commercially profitable, no success has up to quite recently been met with.

A report from the Laboratory of the Internal Revenue Bureau, Washington, dated May 6, 1918, has within the past few days been placed in the hands of the writer. In it experiments are described indicating that the problem of the production of glycerin by the fermentation of sugars in such a yield as to be of commercial significance has been solved.

It seems that Dr. Alonzo Taylor, then Assistant Secretary of Agriculture, reported that when in Germany in the summer of 1917 the Germans were producing glycerin in large quantities by a fermentation process. Investigations were undertaken at four different laboratories in the United States with a view to elucidating the problem, and Mr. A. B. Adams, Chief Chemist of the Laboratory of the Internal Revenue Bureau, Washington, was able to report to the Hon. Daniel C. Roper, Commissioner of Internal Revenue, three months after the work had been assigned to the laboratory, that Mr. John R. Eoff had solved the problem in so far that he was able to produce glycerin in such quantities that if the actual cost of the recovery was not too high the process would be commercially profitable. Details of the process have been furnished to the British and French authorities, and to interested manufacturers in the United States.

The report in which the experiments are described in detail is signed by Messrs. John R. Eoff, W. V. Linder, and G. F. Beyer.

After numerous trials with pure cultures of different yeasts, *Saccharomyces Ellipsoideus (var. Steinberg)*, No. 657 of the collection of the American Museum of Natural History, New York, was selected as most suitable. Preliminary experiments were then instituted which ultimately led up to the following general conclusions :—

The best yields of glycerin were obtained by fermenting solutions of sugars containing 5 per cent. of sodium carbonate, which must not be added to the liquid all at once. A less quantity of the alkali diminishes the yield of glycerin, whilst a larger quantity stops fermentation. Other alkaline substances, sodium hydroxide, potassium hydroxide, and borax may be used, but sodium carbonate (soda ash) is preferable on account of its cheapness. Although no hard and fast rule can be laid down for the method of adding the sodium carbonate, which must be varied according to the nature of the sugar solution, it should be added as soon as the fermentation has well started, and in as large quantities and as frequently as is possible without stopping fermentation. The earlier the addition of the alkali, the higher the yield of glycerin will be. It is necessary that the yeast be "worked up" by making a "bub," and it has been observed that the presence of ammonium chloride in the fermenting liquid augments the yield of glycerin. The most favourable temperature for the fermentation is 30—32° C., and the fermenting liquid should not vary from these limits of temperature for any considerable period. Higher temperatures lead to a loss of alcohol and glycerin, and to the formation of objectionable substances, whilst smaller yields of glycerin are obtained at lower temperatures. The most favourable concentration for the sugar solutions lie between 17·5 and 20 grams of sugar per 100 c.c. It has been found that when fermentation is complete according to the method above outlined, 20—25 per cent. of the sugar originally present in the liquid is converted into glycerin, and practically all the remainder into alcohol and carbon dioxide. The nature of other substances which are formed has not yet been determined. It is mentioned that when the sodium carbonate has been added to the fermenting solution in sufficient quantity, a copious precipitate is formed, the evolution of gas ceases, and the yeast apparently lies dormant for a while. The precipitate eventually disappears and the fermentation again proceeds. It is essential that this precipitate should form, and that the fermenting liquid lie quiescent for a while. The addition of the sodium carbonate in solid form has been found to produce better results than if it be added in the form of a solution.

A description is next given of the process as carried out on a commercial scale, using inedible "black strap" Porto Rico molasses.

The yeast starter or "bub" is first prepared in the following manner. Yeast No. 657 (see above) was seeded with a platinum loop into 150 c.c. of sterile grape juice, and allowed to ferment to the final degree. Fifteen c.c. of this was then added to 150 c.c. of sterile grape juice, and when fermentation had finished 75 c.c. was added to 800 c.c. of a solution of sterilised "black strap" molasses at 21·2° Balling (about sp. gr. 1·085). As soon as brisk fermentation had set in, 3 grams of soda ash was added and the bottle shaken until solution was complete. After fermentation had resumed, and when it had reached its final point, the whole of the liquid was added to 2 gallons * of a similar "black strap" molasses solution, and this was treated at the proper time with soda ash in the same proportion as before. Fermentation being complete, the whole two gallons was added to 40 gallons of a solution made as follows :—

"Black strap" molasses was dissolved in sufficient water to make 425 gallons of wash at 21·2° Balling at 25° C. Eight pounds of ammonium chloride was added, and after the liquid had been sterilised sufficient sterile water was added to bring it back to the original density. This solution contained 16·85 per cent. of sugar. The following are the details of the main fermentation :—

17.11.17., 9 A.M.—40 gallons of wash (see above) seeded (see above).
3 P.M.—2 lb. soda ash added.
9.15 P.M.—The 40 gallons added to 385 gallons molasses wash.

18.11.17., 12.30 A.M.—Added 24 lb. soda ash (T. 30° C.).
3.30 A.M.—Added 36 lb. soda ash (T. 31·5° C.).
5.30 A.M.—Added 48 lb. soda ash (T. 33° C. Attemperated to 30° C.).
11 A.M.—Added 48 lb. soda ash (T. 32·5° C. Attemperated to 30° C.).
5.30 P.M.—Added 36 lb. soda ash (T. 32° C. Attemperated to 30° C.).

The fermentation was then allowed to proceed to completion, which took five days, the temperature being kept at about 30° C.

At the conclusion of fermentation the wash was analysed and the following results were obtained :—Glycerin, 3·1% by vol.; alcohol, 6·75% by vol.; sugar (apparent), 0·86% by vol.; alkalinity, 3·6 grms. Na_2CO_3 per 100 c.c.

The purification of the fermented wash was then carried out as follows :—3200 lb. of the wash was neutralised in a tank with sulphuric acid, and 12 gallons of a saturated solution of commercial ferrous sulphate (copperas) added. The wash having been brought to near the boiling point, milk of lime was added until there was an excess

* The gallon referred to in this article is the U.S. gallon. The factor for the conversion into the British gallon is 0·834.

of lime in solution, when the wash was boiled for half an hour by means of a steam coil. The liquid was next passed through a filter press, and the cake steamed. The copperas and lime treatment was then repeated, and after again being passed through a filter press the alkalinity was brought to 0·2 per cent. (Na_2CO_3) by the addition of soda ash. It was then filter pressed and steamed, and the filtrate evaporated in a vacuum evaporator to a thick syrup which contained between 30 and 35 per cent. of glycerin. It was then distilled in a still resembling that of Jobbin. About 50 lb. of dynamite glycerin was thus obtained, or roughly about *half that present in the fermented wash.*

The following is an analysis of a sample of the dynamite glycerin :—

Sp. gr. at 15·6° C., 1·2616; carbonaceous residue, 0·058%; ash, 0·009%.

The carbonaceous residue is high, but a redistillation of the glycerin gave a satisfactory product. The glycerin was found to nitrate normally.

It is noteworthy that it has been found that the second treatment of the fermented wash with copperas and lime is superfluous. Hitherto it has not been found possible to obtain a perfect crude glycerin from molasses.

Several additional experiments have, it is stated, been carried out on a much larger scale—2000 gallons—with the same results.

It will be remembered that in an earlier part of this report it was mentioned that from 20—25 per cent. of the sugar originally present in the mash is converted into glycerin. Taking the sugars actually fermented in " black strap " Porto Rico molasses as 50 per cent. of the molasses (and this is a very liberal estimate, for it may be computed from the figures given that nearly 3 per cent. of the sugar in the molasses is left unfermented), and remembering that only half the glycerin formed is recovered as crude glycerin, the yield of glycerin could not be expected to exceed 5½ to 6 lb. per cwt. of the molasses dealt with. It is only fair, however, to quote the following remarks of the signatories of the report. They say :—

" It must be borne in mind that there is considerable alcohol produced in these fermentations. At the present price of alcohol and raw materials it is safe to say that the value of the alcohol balances the cost of all material and overhead charges entering into the production of the fermented mash. This being true, then the slop from the alcohol distillation which contains the glycerin is had free of cost, so that the only cost to be considered for the glycerin would be that of purification and distillation. This should not be great. No attempt has been made as yet to recover the alcohol, it being deemed a matter offering no difficulty."

Experiments have also been carried out on a large scale using cane sugar and starch glucose as fermentable material. It was found, however, necessary in these cases to employ yeast foods in quantities that deleteriously influenced the purification of the glycerin. It was therefore concluded that these materials possess no superiority over molasses for the purpose.

Since the process of producing glycerin by fermentation is in its present state of development restricted to molasses, the writer would point out that in some parts of the world, notably in Australia and Fiji, molasses is a waste product which is run out to sea. The present process should, therefore, be of great significance in such countries. There are several details in this process, as outlined in the report, which in the writer's opinion are open to criticism. As, however, a year has elapsed since the report was officially handed in, further developments may have eliminated the applicability of these criticisms.

THE SMELTING OF ZINC ORES.*

The zinc industry has never been one of any substantial magnitude in Great Britain although, normally, this country is a heavy consumer of the metal. Nominally producing some 60,000 tons yearly, probably not more than half this quantity was primary spelter (*i.e.* produced direct from the ore), the remainder being recovered from galvanisers' residues, etc. The need for the establishment of a sound British industry was duly appreciated at an early stage in the war but, although additions have been made to our producing units, the position is still very far from satisfactory. The outbreak of war found the world's production of zinc substantially in the hands of three countries, the United States, Germany and Belgium. Germany and Belgium becoming impossible as sources of supply, we and our Allies were thrown almost entirely on the resources of the United States for our vitally pressing war needs. The result was an enormous inflation of prices, which soared until the quotation for ordinary brands of spelter reached about £115 per ton. More serious still was the case with the special brand of fine zinc with a guaranteed purity of 99·9 per cent. or thereabouts, so essential for the production of cartridge and spinning brasses, which rose at one time to about £180 per ton. The bulk of this, redistilled in retorts, was supplied to us by the United States, but a considerable quantity came from Norway and Sweden, where it was produced by distilling ordinary spelter in electric arc reverberatory furnaces. Our domestic industry did everything possible, with the limited instruments of production at its command, to maintain the maximum output until the incessant demands for men for the army and shortage of zinc ores caused by shipping restrictions had the inevitable result of bringing about a considerable drop in output. Even existing metallurgical works were not able to bring new additions to plant into use, or even to utilise more than a fraction of their original plant. A further limiting factor was the lower grade of zinc ore available, practically all imported ore coming from Spain and Northern Africa with small sporadic shipments from Italy and Sardinia. Coupled with these difficulties, grave enough in themselves, were the restrictions on all stores, iron, steel, refractory materials and fuel.

The demand upon the resources of the United States was so clamant and so enormous that, freed from practically all the disabilities of war, as also from the restrictions caused by Government control, munitions levy or excess profits duty, feverish haste was displayed by private enterprise in that country in not only augmenting output from existing plants to the utmost, but in bringing back into operation derelict plants long abandoned, and in building huge new ones at an unprecedented rate. It is said that at the new plant at Donora productive work with one section actually commenced 143 days after the cutting of the first sod, constructional work having been carried on without pause, night or day, with the assistance of a huge scheme of artificial illumination.

These facts are mentioned in order to emphasise the point that such an atmosphere of scramble on all sides—one where practically all normal considerations of commerce and economics were subordinated to the call for output at almost any cost—was one little conducive to substantial tech-

* From a lecture delivered by J. C. Moulden at the Royal School of Mines on May 1; being the first of a series arranged particularly for the benefit of men who have been away on war service, and dealing with subjects in which there have been recent developments.

nical progress along commercially economic lines. It cannot be said that no progress was made, but it was certainly a minimum in ratio to the work done and tonnage output. In the circumstances, what would under all normal conditions have been metallurgical crimes became virtues.

With the ending of the war we are faced with an entirely new set of circumstances upon which to base our industrial future—circumstances which do not correspond with those of pre-war times nor, of course, with those of the belligerent period, and an intelligent concept of them is a necessity if we are successfully to maintain and expand our domestic zinc smelting which our Government recognises as a key industry. As we now stand, the United States as a producer is so far in advance as to eclipse all others. Germany, previously occupying second place, is an unknown quantity, and Belgium, we are advised, has so far been crippled that two years must elapse before substantial rehabilitation of zinc smelting can take place. Britain has potential plant capable of producing, say, 100,000 tons per annum if in full operation, but adverse factors such as labour, delay in reconstruction, coal, refractories and others, prevent anything like a rapid realisation of this figure. The British Government has arranged to handle the output of the Broken Hill concentrates, formerly contracted for by the Germans. At the time of the armistice, over 500,000 tons of these concentrates had accumulated and they are now arriving in this country to the exclusion of all other ores, with the exception of a little calamine from Italy and Sardinia.

The treatment of Broken Hill concentrates presented, however, special difficulties. The average composition was zinc 47 per cent., lead 4 to 6 per cent. and 8 to 12 oz. silver. The zinc mineral is popularly referred to as blende, but there is practically no real blende in these mines; the mineral is actually marmatite in which the zinc is partly replaced by isomorphous iron and manganese. It is this mineral which causes so much of the trouble in roasting the Broken Hill concentrates, for while the oxides of iron and manganese probably exert a beneficial catalytic action in assisting the removal of the sulphur, they also tend to form a compound of zinc, manganese and iron oxides, practically free from silver and lead and similar in composition to the mineral franklinite, which accumulates on the hearth of the furnace and, if not removed, ultimately breaks the rabbles of the mechanical furnaces. Roasting is carried out in open and muffled furnaces and the latter are essential if the sulphurous gases are to be utilised for the production of sulphuric acid. Muffled furnaces are operated by hand and mechanically. Of the former, the Delplace is greatly superior and uses from 11 to 13 per cent. fuel compared with 18 to 25 per cent. consumed in the Rhenish type. Mechanical furnaces such as the Hegeler and Merton work well with the simpler and cleaner English and American blendes, but are not satisfactory for the complex Broken Hill concentrates. The Ridge furnace is now being successfully used in England on a mixture of English blende and Broken Hill concentrates. Mechanical furnaces are successfully employed at Anaconda, but there the problem is of a different nature. The roasted ores are leached for electrolytic treatment and the aim is to get the maximum amount of soluble zinc sulphate; it is found that if the temperature is not allowed to exceed 732° C. and the amount of air limited, the maximum amount of sulphate and the minimum amount of insoluble zinc ferrite are formed.

In roasting for retort distillation, the total sulphur as sulphide should not exceed from 0·85 to 1 per cent. The temperature necessary to decompose zinc sulphate is between 900° and 950° C. Much had been said of the evil effect of lead in retort distillation but it was not nearly so objectionable as the matte which was formed by residual sulphur and which, by its action on the retort, was probably the worst enemy of the distiller. Ores running so high as 25 per cent. of lead have been smelted without any difficulty. Blast roasting in Dwight-Lloyd machines has been carried out experimentally with some success by Rigg and Warner at Port Pirie, S. Australia, but losses of zinc occur from causes not yet traced.

With regard to retort practice, there is very little progress to report. Mechanical charging machines such as those of Simmons and Dorr-Delattre have been adopted in a few cases, and it is very desirable that they should become more general in Great Britain. The work of Roitzheim and Remy on the use of continuous vertical retorts appears to offer a promising field for research, but full details of the experiments, which were carried out in Germany, are lacking. There is also distinct promise in the idea, carried out at Bartlesville, U.S.A., to distil large tonnages of roasted ore in retorts for a recovery of only 60 per cent. of the zinc, and to treat the retort residues in Wetherill grates for the volatilisation and recovery of the remainder in the form of zinc oxide for use as pigment. The final yield would be high, and the high cost and heavy fuel consumption involved in recovering by distillation the extra 10 or 20 per cent. of zinc in the retort would be avoided. Two other lines of research suggest themselves as worthy of further attention, *viz.*, briquetting or "egging" the ore, and pre-reducing the charge. In retort practice, there were three stages: first, the moisture was driven off; second, the iron oxides were reduced with evolution of oxygen, and thirdly metallic zinc was reduced and volatilised. By the use of preheated ore, an economy would be effected because the retorts would contain more material and less oxygen would be evolved with the probability of a decrease in the amount of blue powder.

In addition to the usual difficulties regarding labour with which this country has to contend, there is a very strong prejudice against zinc smelting. It is admitted by Trade Union officials to be unjust and, although hot and dusty, conditions at the zinc works are no less favourable than in other industries. However, the prejudice exists, and in the economic interests of the industry labour-saving contrivances must be installed.

Troubles arising out of the use of refractories from home sources are not so much due to the lack of suitable material in this country as to the absence of systematic treatment and sorting of such refractories and clays as are available. Great care and judgment are necessary in the choice and preparation. Mixtures containing carborundum, zirconia, etc., have been tried. Zirconia up to 5 per cent. (the economic limit at present cost) showed no improvement in the lasting properties of the retort.

Flotation methods of concentration have not only been of incalculable value in the case of Broken Hill ores but have also rendered electrolytic treatment generally possible. When electrolysis of zinc sulphate solutions was first attempted at Cockle Creek, it was soon found that the acid treatment of the crude ore caused the formation of large quantities of gelatinous silica which prevented filtration with heavy losses of zinc. As flotation concentrates contain very little silica, this difficulty is now avoided. At Anaconda electro-deposition of zinc from sulphate solutions is carried out successfully on a large scale, and at Risdon, Tasmania, 100 tons of electrolytic zinc is being produced weekly. It is not possible to give costs or to prophesy whether the methods will be found

economical under normal conditions. The chief factors for successful working are purity of solution and cost of power. For example, so little as 0·03 per cent. of cobalt in ore is objectionable and must be removed from the solution before electrolysis.

COST ANALYSIS IN CHEMICAL MANUFACTURE.

PART I.

ORIGIN AND SCOPE OF THE GOVERNMENT METHOD.

Two valuable reports on the "Costs and Efficiencies for H.M. Factories controlled by Factories Branch, Department of Explosive Supply," have been issued from Storey's Gate, the headquarters of this branch of the Ministry of Munitions. These reports give very interesting and detailed information as to the costs of production of explosives, and of the acids etc. used in making them, at various Government factories during the war. But of even greater interest than the data contained in the reports is the method of cost analysis adopted in arriving at them, and the uses to which this analysis has been put. The reports illustrate a development in methods of controlling manufacture which chemical manufacturing firms, and especially big manufacturing combines, are likely to find of great service.

A foreword to the second report, written by Mr. K. B. Quinan, explains the origin of both reports by relating how the stimulating system of instructive administration of which they form the text came into operation. Incidentally, he throws light on the history of the development of our explosives manufacture during the war. In the earliest stages of the war the anticipated demand for explosive products was met by enlarging existing factories, a step which not only made possible a rapid increase in production but obviated the need to recruit and train new technical staffs. But the limits of this policy were soon reached, and early in 1915 the Committee on the Supply of High Explosives, of which Lord Moulton was chairman, inaugurated the policy of erecting new and national factories. The following year the scope of these Government Factories had increased to such an extent that a separate branch (the Factories Branch) of the Department of Explosives Supply was organised to administer them. Only when an attempt was made to collect the necessary technical data and assistance from existing factories did it become evident that owing to the extraordinary demands of war there was—practically throughout the entire country—a regrettable lack of available accurate technical data, and an even greater lack of trained technical men. The great explosives and chemical companies of the country were all doing their utmost to meet the call for explosives, and their technical staffs were already sorely overtaxed. It was necessary to rely almost entirely for the staffing of these proposed new factories upon the young and, usually, inexperienced chemists of the country; moreover, the scale upon which manufacture had to be faced was so enormous as to be unique, and it was frequently necessary to devise entirely new methods and plant suitable for bulk production.

Mr. Quinan met these difficulties as follows in the case of those factories of which the construction and operation was entrusted to him. First he arranged that it should be possible to take daily accurate stock of materials produced and in process on any plant, and he had drawn up in readiness, even before the larger factories came into operation, a set of daily, weekly, and monthly technical report forms and a more or less complete system of accounting, so that from the outset information concerning the efficiencies of the various processes and the costs of production could be obtained from those in charge, and could be rendered available for circulation. Further, he inaugurated a system of monthly meetings or technical conferences over which he presided. These were attended by representatives from the various Government factories. At these meetings the work of the various factories was compared—instruction being given as to the technology of the various processes and plants—and the relation between the cost of manufacture and efficiency of working was brought out. To do this the more clearly, a graphical system of costs representation was adopted. This appears throughout the two reports before us, which were prepared for the fourteenth and seventeenth costs meetings respectively—the latter meeting proving to be the last, owing to the sudden suspension of hostilities.

In order to collect and tabulate the technical and costs statistics for these technical meetings, a statistics branch was formed under Mr. S. I. Levy. The first report covers the working of Government TNT and propellant factories, as far as data are available, from June, 1916, to December, 1917. For TNT factories, costs are shown for three six-monthly periods, but for cordite factories data are available for two six-monthly periods only. The second report covers the working of the TNT and propellant factories for the months of May and June, 1918, and for various six-monthly periods up to and including January—June, 1918. In addition, costs are given for the manufacture of calcium nitrate, ammonium nitrate, picric acid, tetryl and ammonium perchlorate, and sections have been included on steam, gas producers and electric power.

It is interesting to note that in this report it has been possible to show costs for many manufactures at two Canadian factories, for American Grillo and chamber plants, for nitric acid manufacture and sulphuric acid concentration at a British trade factory, and for cordite at another trade factory. Evidently the recognition of the value of this comparative costing was becoming more widespread (possibly owing to the printing of the first report), and data from outside sources were being supplied to the Factories Branch, Statistical Section. Figures are also shown for the consumption of materials in tetryl manufacture at the Royal Gunpowder Factory, Waltham Abbey.

The graphs representing the costs have been drawn for comparative purposes. They provide the means of comparing, for any one product or process, the cost:—

(i) At any particular factory during successive periods.

(ii) At different factories during the same period.

(iii) In some cases, with different plant, during the same period—*e.g.*, in the case of sulphur trioxide production on Mannheim, Grillo and Tentelew plant, and, in the case of concentration, on Cascades, Gaillard Towers, Kesslers and Gilchrist.

Hence the graphs show at a glance what improvement a factory is making, how it compares with its fellows, and how the use of different plant affects the costs of working.

In order to make costs comparable, raw materials have been charged to all factories at a uniform flat rate for 100 per cent. materials, and factors have been noted which might operate favourably or otherwise against a factory. For example, in calculating the comparative cost of nitric acid production, although the cost of handling nitre cake has been included, no credit has been allowed to

any factory for sale of nitre cake as some factories were compelled, owing to local conditions, to dump the material; again, since all factories were not provided with nitre bag washing plant, the costs of running this plant, where it existed, have been excluded from the cost of nitric acid production. Similarly, pure glycerin has been charged at a flat rate even when a factory has purified its own glycerin, as in a factory where there is no glycerin distillery the pure material has to be purchased.

A careful analysis has been made of all costs. The cost of production is made up of two main items—cost of raw materials and service charges. On this comparative basis the cost of raw materials reflects directly in most cases, and is always largely influenced by, the efficiency of production. The service charges are divided under five main headings, shown separately on the graphs, but given as a total in the accompanying tables. They are :—(1) Labour, (2) fuel, (3) water, steam and power (denoted by W.S.P.), (4) maintenance, and (5) general. This allocation of costs makes it possible to see at once which are the heavy items of expenditure and where economy might be effected.

The heavier of the two main items in the cost of production is the cost of raw materials, so that economy in raw materials usage stands out at once as a goal to be aimed at. Further, the submarine campaign was making the necessity for this economy urgent from other than financial motives, so that it is not surprising to find from the graphs —*e.g.* Graphs 1A and 3A of the second report—that an improvement in plant efficiency seems to have been the first point to be tackled. There appears to have been rapid improvements here.

The second item in the cost of production, that of service charges, is apt at first sight to be overshadowed by the cost of raw materials, but as economy in the latter was gradually effected the question of services came more and more to the fore, and throughout the second costs report the necessity for economy in this direction is insisted upon. The growing shortage of labour throughout the country was emphasising this point. Again and again in dealing with successive products it is reiterated that service charges have become one of the most important factors in the costs, and in order to point out very clearly the great importance of this item in TNT manufacture, for instance, a special graph (Graph 5B) has been prepared showing the ultimate service charges per ton TNT, the "ultimate" service charges including not only those for the actual nitration process but also the service charges involved in the acid usage, *i.e.* on the denitration plant, the concentration plant and at the retorts.

(A further contribution on this subject will appear in a subsequent issue.)

REFRACTORIES.

Dr. J. W. Mellor delivered recently a course of five lectures on refractories under the joint auspices of the Newcastle Section of the Society of Chemical Industry and of the Armstrong College, Newcastle-on-Tyne. The following is a brief account of some of the more interesting points dealt with :—

The action of heat on clay first drives off hygroscopic moisture and dehydrates the colloidal silicic acid; at 500° C. the clay is decomposed into free silica, free alumina, and water; about 800° C. the alumina begins to polymerise, forming more complex molecules; above 1000° C. alumina and silica recombine to form sillimanite, $Al_2O_3.SiO_2$; at 1500° C. the clay sinters to a stone-like mass; at 1650° C. the clay softens and loses its shape; and at 1700° C. it forms a brown or grey viscid liquid. Some assume that the compound $Al_2O_3.2SiO_2$ is formed when the water is expelled from clay, but there is no evidence for this beyond the fact that the ratio $Al_2O_3 : SiO_2$ is the same before and after dehydration, and this would obviously be the case whether combination existed or not. However this may be, at about 500° C. the bricks or other goods being fired absorb heat without rise of temperature; at about 900° C. they become hotter than the kiln, and afterwards cool down to the temperature of the kiln. Clay expands during dehydration, the specific gravity falling from 2·61 to 2·47 at 600° C., and afterwards contracts, the specific gravity rising to 2·73 after calcination at 1200° C. The contraction results from the vitrification or the closing of the pores, and from the change of the products of decomposition to a mixture with a higher specific gravity. With many fireclays this fire contraction would be difficult to manage, but the percentage contraction is lessened by the use of previously fired fireclay called "grog." The grog acts as a kind of skeleton about which the fireclay vitrifies or sinters. The firebrick is fully matured when, during the firing, it has attained its minimum size. If the minimum size has not been attained during the firing, the brick will contract further when in use. To get the soundest and best possible brick of a given texture it is necessary to use grog which has attained its maximum shrinkage, and to take more than 99 per cent. of the possible fire shrinkage out of the bricks during the burning. A practical test for finding if a brick has been adequately fired is to heat one-half of it in a furnace in which such bricks are to be used, and to compare the result with the half which has not been re-fired.

When alumina is heated, its specific gravity increases from about 2·8 at 600° C. to about 3·9 at 1200° C., corresponding with a contraction of nearly 30 per cent., and such calcined alumina is less soluble in acids, less hygroscopic, etc. The change is exothermic, for heat is evolved at about 1000° C. The contraction of alumina or bauxite bricks is difficult for manufacturers to deal with, since the products are liable to become cracked and distorted, and it is also difficult to ensure that the reaction is completed. Under ordinary firing conditions the change is slow, and takes a very long time for completion. Hence serious difficulties have arisen through subsequent contraction, and makers and users alike have condemned alumina or bauxite bricks. These bricks have really not had a fair trial.

Several other oxides, such as ferric and chromic oxides, undergo analogous changes, but not in so pronounced a degree. Chemists know how these oxides become comparatively inert after calcination. With zirconia the changes are even more pronounced than with alumina. The evolution of heat is so great that the mass becomes momentarily incandescent. Magnesia also undergoes analogous changes during calcination at high temperature, its specific gravity changing from about 3·2 to 3·6, corresponding with more than 11 per cent. contraction. The conversion from A to B magnesite is accelerated by the presence of ferric oxide.

Magnesite bricks are made without the addition of any foreign binding agent. In the manufacture of silica bricks, it is usual to add about 2 per cent. of slaked lime, unless there is sufficient natural clay present to serve as the binding agent; the added time, however, is very prone to cause the formation of silicates, thus rendering the bricks structurally weak and brittle. A small proportion of a plastic clay forms crystals of sillimanite, but even then the bond is stronger with the clay than

with the lime bond. Silica, as flint, is converted into a form of lower specific gravity much more rapidly than when present as quartz, and the evidence is almost conclusive that such conversion is accelerated by the presence of iron oxide in a certain form. This means that in the ordinary process of manufacturing the bricks, instead of getting a 30 per cent. conversion there may be a 60 per cent. conversion. Some bricks made in South Wales with silica rock containing 5 per cent. of ferric oxide were found to give excellent results, one furnace manager declaring that they were the best he had ever had. The presence of iron seems to toughen the lime bond. In Dr. Mellor's opinion, a highly plastic and tenacious clay bond is preferable to lime for silica bricks, the plasticity and tenacity being necessary in order that a reasonably low amount of clay may suffice. A high proportion of either lime or clay bond will lower the refractoriness. As a general rule, in passing from the crystalline to the vitreous condition there is an expansion, and conversely a contraction in passing from the vitreous to the crystalline form. With felspar there is a contraction of about 6 per cent. on crystallising, and if the fused material cools without crystallisation this contraction does not occur. Vitreous quartz also contracts as it crystallises, and vessels made of it shatter as crystallisation occurs.

Some curious results have been obtained in connexion with the penetration of firebricks by dust. With dusts consisting of oxide of iron, copper, or zinc, the penetration is fairly rapid and fairly deep, perhaps an inch in a couple of hours. As there is evidence of the volatilisation of the metals named at surprisingly low temperatures in reducing atmospheres, *e.g.*, copper at 600° C., and iron at 1100° C., Dr. Mellor believes that these metals penetrate the refractory as vapours. A fine-grained texture in bricks is favourable for resisting penetration by vapour or dust. Ferruginous dusts in reducing atmospheres are characterised by rapid slagging, silica bricks especially being readily attacked. With salty coals the salt vapour rapidly attacks silica and fireclay refractories, a very fusible slag being produced. The best results in resisting this action seem to be given by bricks in which the ratio of alumina to silica molecules is less than 1 : 3·5, as in the case of good resisting material containing 6·3 per cent. silica and 30 per cent. alumina.

For withstanding abrupt changes of temperature a porous open texture is most suitable, but there is a limit to the possibilities in this direction owing to the necessity of keeping the materials fairly tough, and in some cases permeability to gases would be too much favoured by porosity. The low thermal conductivity of highly porous materials also renders a porous structure undesirable for low temperature muffles and retorts. Contrary to what are, presumably, the views most generally held, Dr. Mellor believes that at high furnace temperatures a highly porous structure favours the conductivity of heat, and that only at low temperature are highly porous refractory goods of low thermal conductivity. He contends that the effect of radiation across the pore spaces is forgotten, as well as that of convection (*see* this J., 1919, 140 R).

Production of Portland Cement.—The annual production of Portland cement in Europe is as follows (in millions of barrels):—U.S.A. 92·8, Germany 30, Britain 17, France 8, Denmark 7, other European countries 10. Thus the output of the United States far exceeds that of the whole of Europe, a fact which is ascribed mainly to the successful development of the rotary kiln and to the progress of concrete construction on a very large scale in that country.—(*U.S. Geological Survey.*)

NEWS FROM THE SECTIONS.

NEW YORK.

A joint meeting was held on April 18 with the American Chemical Society and the American Electro-chemical Society, at the Chemists' Club, New York. Dr. P. C. McIlhiney, vice-chairman of the Section, presided over an attendance of about 150 members and guests. Dr. W. H. Nichols moved the following resolution which was carried unanimously. "The New York Section of the Society of Chemical Industry, having learned of the death of Sir William Crookes, past-president of the Society of Chemical Industry, desires to record its sense of the personal loss which the Society feels, and of the debt which science owes to him for his brilliant and painstaking researches which have contributed in a high degree to the practical development as well as to the theoretical understanding of the problems of chemistry and physics.

"The death of Sir William Crookes forces upon our attention the fundamental character of the work to which he devoted himself, a field in which the number of successful workers is small, and leads us to express a fervent hope that other men of genius may be stimulated to pursue related lines of endeavour."

Through the efforts of the Perkin Medal Committee two new portraits have recently been presented to the Chemists' Club. The portrait of Dr. J. B. F. Herreshoff, the recipient of the medal in 1908, was presented by Dr. W. H. Nichols on behalf of the General Chemical Company; and the second, that of E. G. Acheson, who received the medal in 1910, was given by Mrs. Acheson. Both Dr. Herreshoff and Mr. Acheson were present and were prevailed upon to give a short account of their careers.

MANCHESTER.

A paper on "The Production and Refining of Edible Oils" was read by Mr. B. P. Flockton at the meeting held on May 2, Mr. Wm. Thomson presiding. The author stated that until the end of 1914 the edible oil industry had received very little attention in this country; it was practically confined to Holland, Germany, Austria and Belgium, British manufacturers being chiefly concerned with the treatment of edible oil seeds to obtain oil for better quality soaps. Many up-to-date plants were now being installed in this country, and in the near future we should be quite independent of outside sources of supply. Further, since 90 per cent. of edible oil seeds were grown within the Empire, this very important industry should provide a field for export. Dealing with the question of extraction, Mr. Flockton said that ordinary rolling was quite inadequate; the reduction must be gradual so that the resulting meal was not granular but flaked. The meal should be heated to a high temperature and moistened to ensure the flow of the oil, otherwise a high percentage of the latter would be left behind, even though abnormally high pressure had been applied for an unnecessary length of time. In order to obtain the maximum yield of oil, the excess of moisture, present in many seeds, should first be eliminated as far as possible. The refining cost varied, but as a rule £5—£6 per ton should cover all overhead and manufacturing charges.

The report for the past session records the holding of seven meetings at which twelve papers or communications were read, the average attendance being about 70. Emphasis is laid upon the usefulness of inviting members of kindred societies to attend meetings, both from the point of view of stimulating local interest in the Society, and from that of inducing co-operation towards common

(local) ends. A generous tribute is paid to the efficient work of Mr. L. E. Vlies, the late Hon. Secretary. The personnel of the new committee is as follows:—Chairman, Mr. John Allan; Vice-chairman, Mr. Wm. Thomson; Hon. Secretary, Mr. L. Guy Radcliffe; Committee, Prof. A. Lapworth, Drs. E. Ardern, T. Callan, Capt. F. S. Sinnatt, and Messrs. W. Andrews, J. Baddiley, W. B. Hart, J. H. Hoseason, S. E. Melling, H. Moore, J. D. Paton, and L. E. Vlies.

LONDON.

At the meeting held on May 5, at Burlington House, W., three papers were read by Dr. P. E. Spielmann and his colleagues, Mr. F. Butler Jones, Dr. S. Schotz, and Mr. H. Wood, respectively.

The first consisted of a critical examination of the relative trustworthiness and accuracy of the several methods for the estimation of carbon disulphide. It has been found that the most accurate method is that of extraction as potassium xanthate, oxidation of this with bromine, and precipitation as barium sulphate. The most convenient method is that where advantage is taken of the diminution of specific gravity due to the removal of carbon disulphide by alcoholic potassium or sodium hydroxide. Estimations involving the formation of copper xanthate were found, on the whole, to be somewhat unsatisfactory. Quantitative estimation by means of phenyl hydrazine appears to be impossible owing to the appreciable solubility of the precipitate in benzene. The chairman, Dr. Charles A. Keane, at the conclusion of this paper, remarked that in estimating copper xanthate the difficulty was always that of obtaining a precipitate of constant composition.

In the second paper on the estimation of thiophene, the methods of Denigès (employing basic mercuric sulphate) and of Paolini and Silbermann (who used basic mercuric acetate) were examined, and in each case the authors claim to have improved and simplified the method of working. Dr. F. B. Thole in commenting on the satisfactory nature of the test, even in the presence of hexylene, questioned whether di-olefines would also be non-reactive, in view of the fact that they gave a precipitate with basic mercuric sulphate.

A particularly interesting discussion followed Dr. Spielmann's third paper on the "free carbon" in tar and pitch. He described the several modes of extraction and the liquids which were tried, from which it seems that the best method consists in the employment of carbon disulphide and benzene in an ordinary Soxhlet extractor. Pyridine is a more far-reaching solvent but requires an all-glass apparatus. In the discussion it was elicited that the commercial value of tar and pitch when used for road-making and as a binder for briquettes is appraised in part by the "free carbon" content.

The reading of the above papers was preceded by the annual meeting and the election of the Committee. The report for the session stated that in spite of the transference of some 58 members to the Bristol Section, the membership of the London Section had risen from 1139 to 1285. Seven meetings have been held, so far, at which 20 papers have been read, and the average attendance has been 122. Reference was made to the visit of M. Paul Kestner in November last, to the initiation of an Inter-Allied Conference of Pure and Applied Chemistry, and to the forthcoming annual meeting of the Society in London. The Sectional Committee on Empire Sugar Production has continued its inquiries and the report will be communicated at the Annual Meeting in July. As an outcome of the discussion on Refractometry, a committee has been formed to consider "Temperature Specification and Methods of Control in connexion with Refractometers." The following members of the Committee retire at the end of the session:—Messrs. W. C. Hancock, J. W. Hinchley, J. Macara, J. W. Macdonald, T. D. Morson, and F. I. Scard; and in their places have been elected:—Dr. M. O. Forster, Messrs. E. V. Evans, E. C. B. Wilbraham, E. R. Bolton, C. Doree, and Capt. G. S. Walpole. As previously announced, Mr. Julian L. Baker succeeds Dr. C. A. Keane as chairman, the latter remaining on the Committee.

BIRMINGHAM.

In the absence of Dr. Morrell, Dr. E. W. Smith presided at the meeting held on May 6 at the University. In the first paper, "Chlorination of Benzene. Analysis of Mixtures of Benzene, Chlorobenzene and Dichlorobenzene, etc.," Prof. P. F. Frankland, Mr. S. R. Carter and Miss D. Webster described a distillation method similar to that used by H. G. Colman for determining toluene in commercial toluol (this J., 1915, 168). From the amounts distilling below 122° and above 142° C. the percentages of benzene and chlorobenzene are obtained from a graph, and the dichlorobenzene is found by difference. The method is accurate and expeditious, distillation being complete in 30—45 min.

The second paper was on "The Application of Colloid Chemistry to the Problems of Physical Metallurgy," by Mr. F. C. A. H. Lantsberry.

MEETINGS OF OTHER SOCIETIES.

ROYAL SOCIETY OF ARTS.

The second "Trueman Wood" Lecture was given on April 30 by Sir Herbert Jackson on "Glass and Some of its Problems." The lecture was mainly of an experimental character; the complementary descriptive matter will appear in due course in the Society's *Journal*.

After a few explanatory remarks on glass and its constituents, the lecturer proceeded to discuss the question: Is glass a solid? He showed that the dictionary definition of a solid as a substance with a fixed form whose particles are not free to move, certainly did not apply to glass which possesses marked viscosity through a long range of temperatures. Dealing with the sealing in glass of metallic wires, Sir H. Jackson explained that thermal expansion is by no means the only factor to be considered. Thus a glass that will hold copper and platinum wires will not retain iron or nickel wires. The coefficient of expansion of copper is about double that of iron, and those of iron and nickel are intermediate between the two. The difference is due to the fact that copper and platinum are relatively soft and the other two metals hard: the glass as it cools pulls and deforms the former but not the latter. In regard to the problem of structure, the lecturer said that he had never seen perfectly vitreous glass except in small pieces; he inclined to the view that every substance has both a crystalline and an amorphous form. The vitreous form of white arsenic would be very valuable for use in optical glass if it could be preserved, and a method of stabilising it was wanted. Certain experimental data obtained by etching glass and by spreading on it very strong liquid glue did not prove its crystalline nature, but the phenomenon of fluorescence was truly indicative of that state; he knew no single instance of a truly vitreous substance showing phosphorescence. A crystal of zinc silicate was divided into two and each part powdered. One portion was vitrified by a very sudden cooling; it did not phosphoresce; when, however, it was heated it became crystalline and phosphorescent. Many of the constituents of glass exist

in both forms, *e.g.*, the borates, phosphates and silicates of calcium. Nearly all vitreous substances show a tendency to crystallise at some temperature. No change occurs when a super-saturated solution of sodium acetate is cooled with ice and salt or with solid carbon dioxide, but, as the lecturer demonstrated, at the temperature of liquid air, solid vitreous acetate separates out, and on warming suddenly becomes crystalline inducing momentary crystallisation of the whole mass. A similar experiment was performed with Rochelle salt, but in this case the vitreous solid does not change on being warmed, and consequently no crystallisation occurs.

The rest of the lecture was devoted to demonstrating the formation of opal and coloured glasses. Four transparent bulbs of the same glass showed different degrees of opacity on being heated to different temperatures, and a transparent bulb containing gold became successively pink, dark red and blue, the colours produced depending on the size of the particles liberated. Three clear glasses containing the same proportion of nickel but different alkalis (potash, soda and lithia) became violet, brown and yellow, respectively. Boro-silicate glass was changed by heat into violet or yellow according to the proportion of alkali present. The lecturer emphasised the analogy between the phenomena shown by glasses and by solutions, and exhibited on the screen some beautiful experiments showing the reduction of gold solutions with semicarbazide in the presence, and absence, of tannic acid as protective colloid.

THE IRON AND STEEL INSTITUTE.

The annual general meeting of the Iron and Steel Institute was held on May 8 and 9, at the Institute of Civil Engineers, when a large number of papers was presented.

M. L. Greiner presented a "Report on the Condition of the Belgian Iron and Steel Works after the German Occupation." He described in considerable detail the deplorable condition of the whole of the industry, and its effect on the future position of Belgium as a manufacturing nation; in particular he drew attention to the wanton manner in which whole establishments had been put completely out of action by the careful destruction of vital machines in a systematic manner. His report was amply confirmed by a number of the members present, particularly by Mr. Harbord and Mr. Mather, who were able to describe personal experiences in the devastated area.

Mr. L. C. Harvey read a paper on the "Use of Pulverised Coal." This was a supplement to a recent report submitted by the author to the Director of Fuel Research, and dealt, among other things, with the application of pulverised coal to steam raising, the generation of motive power, and as a source of heat in metallurgical works.

A contribution by Mr. C. H. F. Bagley on "Modern Steel Metallurgy" described a system worked out by himself some years ago, mainly in connexion with the basic open-hearth process, the object of which is to render more simple and reliable the methods of calculating the consumption of materials and the technical results in the manufacture of steel from any kind of pig iron by any standard process.

Mr. J. C. W. Humfrey, in a paper entitled "Macro-etching and Macro-printing," described a method for the development of the macro-structure of steel ingots and forgings. The etch produces on the surface of the specimen a relief structure which is simply the original cored structure of the ingot; the specimens can be used as blocks for the production of direct contact prints, and the paper is illustrated with a number of such contact prints from the steel specimens. A paper by Messrs. W. H. Whitely and A. F. Hallimond described the results of investigations into the microstructure of slags, the structure of the hearth in the acid open-hearth process, and the reactions occurring in the molten slag during the process. The paper is illustrated with many excellent micrographs. The "Manufacture of Files" formed the subject of a paper by Mr. Geo. Taylor. He gives much information with regard both to the mechanical and metallurgical processes of manufacture. His paper will form one of the most complete works of reference available on the subject at the present time. Dr. J. H. Andrew and Mr. G. W. Green described in considerable detail the manufacture and treatment of certain kinds of high speed tool steel. Four different ingots were followed through every stage in the process of manufacture. The treatment described represents the standard practice carried out in the works of Sir W. G. Armstrong, Whitworth and Co. Ltd. A paper by Mr. D. Hanson and Mr. J. E. Hurst gives an account of the method adopted to overcome certain difficulties in the case-hardening process. Various troubles, which were traced to the presence of films of free cementite in the case of the finished articles, were entirely overcome by the adoption of certain slight modifications of the process, which were described.

A considerable number of papers could not be read at the meeting on account of lack of time. Of these mention may particularly be made of one by M. A. M. Portevin and M. Garvin on the "Experimental Investigation of the Influence of the Rate of Cooling on the Hardening of Carbon Steels." The meeting also included a joint session with the Institution of Electrical Engineers, at which a selection of papers on electric furnaces was discussed. These included papers by W. K. Booth, R. G. Mercer, A. Sahlin, V. Stobie, J. Bibby, and H. A. Greaves.

INSTITUTION OF MECHANICAL ENGINEERS.

On May 2, Dr. W. H. Hatfield read a paper on "The Mechanical Properties of Steel, with some consideration of the question of Brittleness," in which he discussed generally the question of brittleness and the relationship of the results of various mechanical tests to the failures of parts in service. The various forms of mechanical tests in use and the data they provide were reviewed, and the opinion expressed that the tensile test and the data derived from it are the fundamental factors indicating the strength and condition of a steel, but that all the other tests give additional and distinct information not so revealed. No special reliance should be placed on any one form of test. The results obtained from different forms of mechanical tests on a variety of steels were discussed and several outstanding facts of much interest were brought forward. The conclusion was reached that real brittleness in service is distinct from notch brittleness, and whilst a really brittle steel will always give a low value under the notched impact-test, a low value under such test does not necessarily denote a really brittle steel. Real brittleness is readily distinguished by tests other than the notched-bar test.

THE CHEMICAL SOCIETY.

On May 15, with Sir J. J. Dobbie in the chair, Mr. B. Blount and Dr. J. H. Sequeira read a paper on "'Blue John' and other forms of Fluorite." The object the authors had in view was to determine the exact cause of the coloration of the mineral; in this they were unsuccessful, but a number of interesting observations were recorded.

Chemical analysis showed that specimens of the blue and green forms of fluorite had practically

identical composition, *viz.*, over 99·5 per cent. of calcium fluoride, traces of aluminium and/or iron, and of manganese, and a very minute trace of magnesium. The analytical figures led to the conclusion that the coloration was not due to mineral constituents. The hypothesis that it might be caused by an organic dye was tested by extracting with organic solvents; of these only two, chloroform and toluene, yielded an appreciable quantity of extract, and this was found to contain less than 0·05 per cent. of carbon. Numerous experiments with radium compounds led to the inference that the coloration was not of radio-active origin. When the crystals are heated to 350° C. in a sealed tube, a liquid (chiefly organic) is expelled, decrepitation occurs, and the mineral becomes white, and, when hot, fluorescent. On cooling the colour is not restored. The authors incline to the view that organic matter is the cause of the coloration.

The proposed alterations in certain of the Society's by-laws were carried at a special meeting held on May 8. Women will now be eligible for election to the Fellowship.

THE ROYAL SOCIETY.

Prof. W. A. Bone and Mr. R. J. Sarjant contributed a paper on "The Action of Pyridine upon the Coal Substance" at the meeting held on May 15. It was shown that the presence of oxygen has an important retarding action upon the extraction process (the extent of which varies considerably with the nature of the coal), and that in order to obtain consistent results in any such process, it is necessary not only to employ an anhydrous solvent, but also to exclude oxygen. A suitable apparatus and method were described for carrying out the process under standard conditions, such as will give consistent results of comparative value with various coals. The application of the method to two typical isomeric bituminous coals was fully described. When such extraction is carried out at ordinary pressures, with exclusion of oxygen, a practical limit is finally attained. In the case of the two coals in question, this limit considerably exceeded the amount of "volatiles" yielded by them on carbonisation at 950° C. At higher pressures this first limit was considerably passed, and when conducted in sealed tubes between 130° and 150° C. as much as two-thirds of the coal substance was rendered soluble.

The results as a whole indicate that neither pyridine alone nor even pyridine in conjunction with chloroform is capable of extracting in a pure condition the resinic constituents of the coal substance, and that in addition to any ordinary solvent action which pyridine may have upon such constituents, it also at the same time slowly attacks and resolves into simpler molecular aggregates the complex structure of the coal substance as a whole, for which it has a marked affinity.

Chemical Industry Club.—The monthly meeting of the Chemical Industry Club was held at the Club Premises, 2, Whitehall Court, S.W., on May 19, with Dr. Hodgkinson in the chair. During the evening the Honorary Secretary, Mr. H. Edwin Coley, gave a description of the Chemists' Club in New York, and referred to the arrangement that has been made between the English and American Clubs under which members of either Club can acquire temporary membership in the other, without payment. Mr. J. Lainson Wills, of St. Louis, U.S.A., was present and gave an address on "The Effect of Prohibition on the Brewing Industry in America." The membership of the Club now totals 584, inclusive of applications, and there is every sign of continued prosperity.

NEWS AND NOTES.

CANADA.

Potash from Cement Plants.—The Canada Cement Co. is planning to establish a potash recovery plant (spray system) at Port Colborne, Ont. This indicates confidence in the permanent success of such a project under any conditions which are likely to prevail in the Canadian potash market.

Recovery of Fish Scrap.—Partly as a result of Government action and partly as a result of previous trials, there has been recent growth in the interest taken by some companies in utilising the fish waste of the Eastern Provinces. The market for fish meal and oil is a large one, and plants for handling fish scrap are expected to increase rapidly in Nova Scotia and the East.

Copper in Northern Manitoba.—During the war much prospecting was done in districts along the new Hudson Bay Railway. Starting at The Pas a mining country is rapidly opening up. Payable quantities of copper, gold, and silver ores are already blocked out in many localities and the Government has decided to build a railway seventy-five miles from The Pas to the Flin Flon property. When this has been done the owners will proceed with their project of putting up a smelter capable of handling 2000 tons of sulphide ore per day. This Manitoba area is one of the newest and most promising in the Dominion, especially as a copper producing area.

The Protection of Canadian Chemical Industries.—The electrochemical industries at Niagara Falls, Ont., and Shawinigan Falls, Que., are in the main well situated to meet American and other foreign competition. There is some danger at Niagara Falls that in the course of time the multiplicity of users of electric power under public ownership may make it difficult for the electrochemical users to obtain sufficiently cheap rates. Other chemical industries, however, are looking for some special consideration on the part of the Government. Users of industrial alcohol have succeeded in getting legislation before Parliament this session, and it is expected that alcohol of a high grade of purity will be available for all industrial users at a price which will be quite satisfactory. A number of the smaller manufacturers who were able to make successfully a few chemicals during the war period are having difficulties in holding their business under the reduced prices, and if they are to continue their capital must be greatly increased. Companies engaged in pharmaceutical preparations have been able to extend and hold business, and are not in special need of attention. Companies engaged in chemical industries based on salt are not so well situated, and although Canada has all the raw materials and large plants established for the production of soda, chlorine, bleaching powder, and soda ash, the low prices at which American companies were able to obtain surplus war products has had a 'dumping" effect on the Canadian market. Some measure of increased protection and limiting of importations of products already available here is likely to follow.

British Columbia.

British Columbia Department of Industries.—The Provincial Government has passed legislation to raise $2,000,000 to be administered by the new Department of Industries to promote industrial research, survey natural resources, co-ordinate industries, investigate and give financial assistance to new industries, and generally to further the economic development of the province.

Minerals, Metals, etc. The Provincial Government intends to establish an ore-testing laboratory and mineral research station at the University of British Columbia.

The New Hazelton Gold-Cobalt Mines, Ltd., has received from the Dominion Government ore-testing laboratory the returns on a consignment of 26 tons sent to Ottawa last August. The contents comprised molybdenum, cobalt, nickel, arsenic and gold, and the gross value was $2399·5. Quite recently, 28 tons shipped to the Anyox smelter gave $1090 in gold, or $53 per ton net, after paying railway and smelter charges. This mine, which is situated on Rocher de Boule mountain, four miles from the Grand Trunk Pacific Railway, promises to develop into one of the richest in the province.

Copper.—The Canadian Government is being urged to establish a copper smelter on the Pacific Coast to avoid the necessity of exporting Canadian ore to smelters in the United States. The big Granby Smelter at Anyox, B.C., has resumed operations after being idle for a month, when stocks on hand amounted to over 8000 tons. On March 1 there was 400,000 tons of copper in the North American market, 50,000 tons of which was sold up to April 1 at 14 to 15½ cents per pound.

An improvement in the process of leaching roasted ores is being demonstrated in Vancouver by Mr. C. J. A. Dalziel. The ore particles are agitated in sulphuric acid solution by jets of air. The copper is dissolved out in 24 hours, and the clear solution is siphoned off directly into electrolytic cells.

The Canadian Geological Survey has reported on the important discovery of copper ore at the head of Gun Creek on Copper Mountain. The survey shows an ore body 800 by 2500 feet, with vertical exposure of 200 feet, giving 30,000,000 tons estimated in exposed portions. Samples assay 1·5—8 per cent. copper, with an average of about 3 per cent. Outlying deposits have yielded samples assaying $9 gold, 7 oz. silver, and up to 31 per cent. copper.

Mining Convention.—The International Mining Convention, held on March 17-19 (this J., 1919, 142 R), reflected the intense interest which is being taken in the mining developments of the province; over 500 delegates attended. The mineral resources are both large and varied; the fundamentals, iron and coal, are present, and upon these the growing shipbuilding industry mainly depends. The prospects of obtaining precious metals are hopeful, especially in regard to platinum. Over 200 delegates visited the Britannia copper mine on Howe Sound, which is said to be the largest copper mine in the Empire. The Convention passed a recommendation asking the British Government to abolish the present fixed price of silver, and a resolution was passed requesting the Canadian Government to re-establish old postal rates on United States mining and scientific journals. Among the numerous papers presented were: "Mineral Resources of British Columbia," by the Hon. W. Sloan, Minister of Mines; "Gold," by H. N. Lawrie; "Government Control of Smelters," by S. Norman; "The Better Preparation and Utilisation of Coal," by G. W. Evans, of the U.S. Bureau of Mines, and F. W. Glover; "Taxation of Mines," and "Industrial Welfare."

AUSTRALIA.

Mineral Deposits along the Trans-Australian Railway.—The Commonwealth Railway Commissioner has recently reported on the territory opened up by the Trans-Australian Railway. Besides gold discovered in Tarcoola in 1900 and worked under very great difficulties, the following minerals are found along the route. A valuable opal field was discovered in 1915 in the Stuart Range, N.E. of Tarcoola. It has an area of 10×2 miles, and, in the opinion of the South Australian Government geologist, constitutes a very important mineral discovery. Deposits of manganese ore are found upon the western fringe of the Pernatti Lagoon, 4 miles N.E. of Woocalla, and quantities are now being carried by rail to Port Augusta for shipment. Deposits of high grade barytes also exist in the same district. Copper ore occurs near Woocalla and at Mount Gunson, and tin ore in the vicinity of 230 miles from Port Augusta. Gypsum is found in the neighbourhood of Hesso, 34 miles from the latter port, and deposits of chromite and ochre are reported in the same locality. Large deposits of valuable clay exist near Woocalla suitable for certain types of pottery not hitherto manufactured from Australian clays, and salt is found in abundance in Lake Hart and other lagoons. Consignments are dispatched regularly to the seaboard and a heavy traffic is anticipated. —(*Bd. of Trade J., April* 24, 1919.)

SOUTH AFRICA.

The Sulphuric Acid Industry.—Owing to its connexion with the manufacture of explosives, the sulphuric acid industry is one of the most highly developed in the Union. The five firms engaged in it produce about 53,000 tons of sulphur trioxide a year, most of which they consume themselves in the manufacture of explosives, so that in the year 1916—1917 only 2934 tons of sulphuric acid was available for disposal. The manufacture of ammonium sulphate requires about 2590 tons of commercial acid yearly and the cyanide process for gold about 1800 tons of arsenic-free acid. Minor quantities are employed for making superphosphate, for splitting fats, etc. Messrs. Kynoch, Ltd., advertise a chemically pure acid which conforms to the standard of the British Pharmacopœia.

Before the war the raw materials were almost wholly imported, the sulphur chiefly from Sicily (Sicily seconds), and as Spanish pyrites. The imports for recent years are :—

	1914 tons	1915 tons	1916 tons	1917 tons
Rock sulphur, including pyrites	3900	14,000	25,700	18,500
Flowers of sulphur	1120	1140	3500	900

The increasing difficulty in obtaining sufficient imported sulphur to supply the growing demand has directed attention to South African sources, and large quantities of local pyrites, mainly concentrates from the gold mines, are employed in the chamber process, but at a considerable expenditure for new furnaces. No information is available regarding the possible use of pyrites in the contact process.

Free sulphur, of no commercial value, occurs along the coast around Walvis Bay and Conception Bay, and deposits of unknown value have recently been found near the mouth of the St. John River, Griqualand East. Notwithstanding possible developments, as at Areachap in the Cape, no large deposits of massive pyrites are actually known. There are however many unopened gossan outcrops in the older formations, and practically all the gold ores of the country contain from 5 to 35 per cent. of pyrites. While the Main Reef is on the whole poor in pyrites the percentage in the Black Reef is comparatively high, with only a trace of arsenic.

The New Transvaal Chemical Co., Delmore, works up auriferous pyrites to refractory concentrates which are roasted in specially designed furnaces, a process in operation even before the war. Near Germiston, Pyrite Ltd. produced in 1916, 4300 tons of pyrites (50 per cent. sulphur) from accumulated tailings. At Sabie, in the Transvaal, there are said to be 40,000 tons of tailings and sands which would yield about 4000 tons of concentrates free from arsenic and antimony and containing about 40—50 per cent. of sulphur. The same quantity of concentrates could be produced yearly. The New Areachap Copper Mines Ltd., Gordonia, Cape Province, works marcasite (39—48 per cent. sulphur), of which 30,000 tons is estimated to be in sight. The Barberton district could produce 1000 tons of

concentrates a month containing over 40 per cent. of sulphur and appreciable quantities of gold.

Should the price of sodium nitrate continue to rise it might be possible to utilise local potassium nitrate, such as that found near Prieska, if the potassium were available as a fertiliser. Lead of high quality is produced at the Broken Hill mine in Northern Rhodesia, and the erection of plant for rolling sheet lead on the Rand is under consideration. Most of the necessary machinery could probably be built locally. A small quantity of the spent oxide from the pyrites burners is converted into basic ferric sulphate for use in the refining of glycerin, and some of the oxide is possibly made into paint. The shortage of drums is not acute, but glass and earthenware containers are very scarce.—(*S. Afr. J. Ind., Feb.*, 1919.)

The Barytes Industry.—Barytes is widely distributed in South Africa, the chief deposits occurring in Southern Rhodesia near Hunters Road and near Bulawayo, in the Cape Province near Riversdale, and in the Transvaal on the Magalaquen River. The principal consumers are the explosives factories and paint manufacturers, and a small quantity is used by rubber tyre manufacturers. Some of these are supplied from the deposits indicated above. The imports of barytes into the Union for the six months ended September 30, 1917, were 28,316 lb. It is doubtful whether the South African requirements amount to five tons per month.—(*S. Afr. J. Ind., Feb.*, 1919.)

UNITED STATES.

The American Chemical Society.—The 57th meeting of the American Chemical Society in April was called the Victory Meeting, and was one of the most successful in the history of the Society. Nearly eleven hundred members attended, and the programme was varied and interesting. Dr. Irving Langmuir's presentation of his newly developed theory of the arrangement of electrons in atoms and molecules evoked much discussion. The symposium on library service in industrial laboratories was unique and brought out many valuable points.

The Council of the Society enlarged its committee on reagents to deal with the standardisation of American-made scientific apparatus, took action urging the President to appoint a high commission to co-ordinate the work of developing the country's natural resources, elected the Italian scientist, Ciamician, to honorary membership, instructed the journals of the Society to avoid foreign language quotations, whenever possible using English translation instead, considered numerous other matters and discussed the reports of nearly forty committees. The Society now has more than 13,000 members.

A report by the Omnibus Committee was considered of such importance that it will be printed in the May issue of the *Journal of Industrial and Engineering Chemistry* in order that comments may be made by members and definite action taken at the September meeting. The committee dealt with 178 suggestions from 20 sections, 8 individuals, 2 outside and 5 unidentified sources.

The plan for co-operative work with English chemists in preparing compendia of scientific literature was received with enthusiasm.

Reinforced Lead Sheets.—A successful process for reinforcing sheet lead with lead-coated iron wire has been devised. This new material is well suited for lead chambers etc., and large pipes can be made from it. Such reinforced lead ¼ in. thick made into a pipe of 8 in. diameter withstood eight times as much pressure as the same sized pipe with ⅜ in. walls of the usual lead without reinforcement.

The Optical Glass Industry.—The new optical glass industry is on a very satisfactory foundation. The three producers who made glass primarily for their own use will continue to do so and are prepared to sell to others. The quality in some cases is superior to German glass, and there is a determination to continue improvements regardless of cost. Important progress has been made in pots and the furnace cycle has been greatly reduced, as well as the time for annealing.

GENERAL.

Endowments for Chemistry and Metallurgy at Cambridge University.—A munificent gift of £210,000 has been made to Cambridge University for developing the chemical school under Sir W. J. Pope. The donors are connected with the petroleum industry and include: The Burmah Oil Co., £50,000; the Anglo-Persian Oil Co., £50,000; the Anglo-Saxon Petroleum Co., £50,000; Viscount Cowdray and the Hon. Clive Pearson, £50,000; and Mr. H. W. A. Deterding, £10,000.

The Goldsmiths' Company has offered a sum, not exceeding £5500, to the University for the purpose of extending and equipping the Department of Metallurgy. The Goldsmiths' Readership in Metallurgy was founded by the Company in 1908 and Mr. C. T. Heycock was appointed Reader. The metallurgical department was at first housed in two rooms in the Chemical Laboratory, but the number of students rapidly increased and, when the Department of Agriculture left the Chemical Laboratory in 1910, Sir William Pope assigned the rooms thus vacated to metallurgy, the Goldsmiths' Company contributing the sum of £800 for their alteration and equipment. The number of students working at metallurgy has now increased beyond the capacity of the present laboratory, and the generous gift of the Goldsmiths' Company will provide a new analytical laboratory with benches supplied with compressed air and high and low voltage direct current, a balance room, and also a room for general galvanometer and photographic work with eight gas furnaces round the walls. Accommodation for sixteen students working at assaying and general mineral analysis, and for ten research students, will thus become available.

Proposed Manufacture of Beet Sugar in Scotland.—War conditions are giving rise to new and diverse industrial enterprises. When we recollect that in peace time we bought something like £14,000,000 worth of beet sugar from Germany and Austria, and that our trade relations with Germany cannot revert immediately to their previous state, and when we further realise that our cane sugar producing colonies will barely be able to provide us with our annual pre-war consumption of 90 lb. per head of population, we may expect frequent proposals for developing the supply of home-grown beet sugar. One of the latest of these hails from Ayrshire, where a syndicate has been formed for growing sugar beet for the purpose of manufacturing sugar. The financial part of the scheme has not yet been agreed upon, except in so far as all idea of Government support has been abandoned, since the Development Commission has refused assistance on the ground that money is not available for companies trading for profit; moreover, the Treasury does not yet appear to have given its consent to the raising of the necessary capital privately. On the other hand, Sir R. B. Grieg, Commissioner for the Board of Agriculture, Scotland, writes confidently of the effect such an industry, when once profitably established, would have on that district, where the soil conditions are eminently suitable for the cultivation of beets which would take the place of turnips in the usual rotation. The deep and careful cultivation, he writes, would improve the capacity of the soil for other crops; it would employ additional labour; it would stimulate and increase the demand for fertilisers; in fact, it should produce an all-round

improvement in the farming of the area. It is proposed to erect a factory about 1 mile from Stranraer, the Wigtownshire harbour. From here a daily service runs to Ireland, which might possibly be employed for sugar export business to Ireland. In addition to supplying seed, fertilisers and labour to lift the crops when they are ready, the syndicate propose to make the experiment of paying the growers £8 an acre, to meet rent, cost of ploughing and so forth, and anticipate a substantial profit; it is, however, prepared to revert to the usual custom of paying the growers for the actual amount of roots delivered, according to sugar percentages, if they should prefer it.

Recovery of Wax from Waxed Paper.—In connexion with the note which appeared under this heading in the issue of April 30 (p. 143 R), Mr. M. S. Salamon writes that it may be of interest to our readers to know that in this particular case Britain is ahead of the United States. The initial experiments were carried out some eighteen months ago, and showed that the only commercially successful process involved the extraction of the wax by means of a volatile solvent. In the last nine months there has been in course of erection at Nutfield, Surrey, a plant capable of dealing with large quantities of waxed paper, and also special machinery for preparing the material for extraction and for handling the various products after extraction. This factory is practically ready to start operations. In addition to reclaiming the waste waxpaper, the plant will also deal with waxed paper or board containers, such as have been used so extensively for storing jam, margarine and other foodstuffs.

The Sensitiveness of Guncotton to Shock.—A report, by H.M. Chief Inspector of Explosives, has recently been issued concerning an explosion which occurred at an Edmonton munitions factory on February 5, 1919. The work being performed at the time was the breaking up of Russian trench mortar charges contained in boxes holding bags of guncotton in the form of yarn, and bags of flaked cordite. H.M. Inspector records the impossibility of ascertaining the exact cause of the accident, but holds that it was most probably due to the extreme sensitiveness to shock of a thin film of the guncotton fluff or dust. The evidence indicates that a fire started at the zinc-lined wooden box into which the guncotton was being discharged. This receptacle had a circular opening lined with tinplate, and the tin had probably worn off, leaving the iron beneath exposed. "In these circumstances the fall of even a bronze tool, such as the scissors with which the bags were opened, or a glancing blow from a ring on a worker's hand, might well give rise to sufficient local heat to fire the thin film of guncotton dust with which the rim of the opening would undoubtedly be covered."

An explosives expert writes that, in his opinion, guncotton is not so sensitive to shock as the above explanation would imply. After repeated trials, he failed completely to explode perfectly dry guncotton, dusted on to an iron sheet about 1/50 in. thick placed on a table, by striking it with a pair of steel scissors weighing about 4 oz.; or by a small iron ring slipped on to the end of a wooden rod, by which means a far more severe blow can be given than with a ring worn on the finger. Alternatively, he suggests that the guncotton fluff, which is extremely sensitive to flame, might have been fired by a very small spark produced by a stone in the ring. He points out, however, that explanations of the above kind are purely conjectural and there is a danger in giving premature publicity to them. Many accidents have occurred in munition works under more or less similar circumstances. Owing to lack of evidence, a very conjectural explanation is advanced to explain the first occurrence. After the second the same explanation is given, the former case being used as an added argument in its favour, and by the time the third accident has happened the original guess is taken as a proof that the accident actually happened in such a manner. This is entirely unwarranted, unless it is possible to show that the only circumstances common to all the accidents are those upon which the explanation is based. This point is particularly emphasised because the acceptance of an incorrect explanation leads to the omission of further search, may prevent the discovery of the true cause, and gives a false sense of future security.

Egyptian Phosphate Resources.—Large deposits of phosphate similar to that of Algeria and Tunis occur over large areas in Egypt. These deposits are being worked at Safaga and Kossier on the Red Sea and at Sebaia on the Nile, but there are other large areas which offer good opportunities to the prospector. The production during the past nine years has fluctuated widely:—

	Metric Tons		Metric Tons
1910	2,397	1915	82,998
1911	12,013	1916	125,008
1912	70,918	1917	115,732
1913	104,450	1918	31,147
1914	71,045		

The rock is either exported as such, or converted into "Tetra phosphate" (this J., 1918, 437 R). The greater part of the output prior to the war went to Japan, but of late large stocks have accumulated owing to want of shipping. The quality of the rock varies, the best grade contains calcium phosphate 70%, iron and alumina 1·5%, a middle grade 64 and 2·75%, and the lowest quality 60 and 3%, respectively. The better qualities come from the Red Sea districts. To meet the native demand, superphosphate has been imported into Egypt during the past few years:—In 1913, 13,148 metric tons; in 1914, 15,278 tons; in 1915, 7,056 tons; and in 1916, 3,250 tons.—(*Bd. of Trade J., April* 10, 1919.)

Resources of the British Occupied Territory in the Cameroons.—During the war the Cameroons has been cut off from the outside world, and the present position of trade is no indication of the resources of the country. One great drawback to trade is the lack of roads and railways, but there is an excellent but little-used harbour at Victoria. Both tropical and sub-tropical products can be grown, and a great part of the country is rich in palm tree forests, especially in the lower Chang, Rio del Rey and Ossidinge districts; in the last district the Germans erected a considerable plant for dealing with palm kernels. Ground nuts are being grown on an extensive scale and will probably form one of the chief exports. In the Chang division there is a large area of elevated land (about 4000 ft. above sea-level) which is eminently suited for European settlement and where cereals, fruit and vegetables can be grown successfully. A remarkable vegetable fat, which after a very simple refining process is converted into a product resembling beef marrow fat, is obtained at Buea from the fruit of the "Ngaby" tree. When rubber prices are high it may be profitable to tap the vine rubber which grows in quantity in Ossidinge. The volcanic soil of the mountains is specially suited to cocoa cultivation, while tea and quinine can also be grown.

There are large iron ore deposits at Bamenda and several native smelters are working in a very crude fashion. Chalk and a fair quality coal have been obtained in Chang. Numerous salt springs occur in Ossidinge, but the salt produced is not sufficient to meet the native demand. The popu-

lation, especially that of Chang, is intelligent and enterprising.—(*Bd. of Trade J., April* 10, 1919.)

Mexican Guano Deposits to be Exploited.—On December 6, 1918, the Mexican Government granted to General Lucio Blanco a concession for exploiting guano deposits on the islands Isabela and San Juanico in the Pacific. The contract is for five years, renewable for another five, and permits the removal of a minimum of 2000 tons of guano annually, the concessionaire paying the Government 1·50 pesos ($0·75=3*s.* 1*d.*) per metric ton.—(*U.S. Com. Rep., Mar.* 3, 1919.)

Mineral Production in Italy.—The following statistics have been compiled by the Inspectorate General of Mines :—

Mineral	Production 1916	Production 1917
	Tons	Tons
Anthracite	18,544	25,194
Triassic coal	—	20,250
Lignite	1,282,019	1,656,963
Bituminous shales	4,477	19,750
Antimony	6,509	5,789
Iron	942,244	993,825
Ferro-manganese	4,360	4,800
Manganese	18,147	24,532
Lead	39,460	38,076
Copper	88,475	86,842
Tungsten	7	1
Zinc	94,043	79,453
Boric acid	2,298	2,335
Mineral waters	35,900	35,900
Aluminite	3,370	4,855
Bauxite	8,887	7,789
Graphite	8,172	12,117
Mercury	1,093	1,071
Petroleum	7,035	5,668
Iron and cupreous pyrites	409,900	500,783
Asphalt rock	10,829	8,615
Salt from springs	10,943	12,733
Rock salt	67,227	55,775
Sulphur	287,965	230,974

There are now 18 companies engaged in the Italian mining industry, their combined capital standing at the end of 1916 at the equivalent of 6¾ millions sterling. The chief centres of the industry are in Sicily, Tuscany, Sardinia, and especially at Bergamo, Brescia and Turin.

The lignite figures for the early months of 1918 do not show great promise, and it is specially noticeable that the larger mines are falling off both in total output and in the output per worker. On the other hand some of the smaller mines have largely increased their production.

The problem of potash supply is now being investigated by the Office of Inventions and Research, which points out that although the size of the iron smelting industry does not allow of an output from flue dust recovery on the scale of the English plants, yet a considerable amount of potash can be obtained from this source as well as from the flue dust from cement kilns, from molasses and olive residues, from wool grease and from seaweed. There are two other possible sources, namely the mother liquors from the salt mines and the deposits of leucitic rocks (double silicate of aluminium and potassium). If a successful process can be evolved for treatment of the latter, it would provide an almost inexhaustible source of potash. Previous to the war about 23,000 tons of potash salts was imported from Germany annually. Geological investigators predict that in Sicily there is a total possible sulphur bearing area of some 2,000,000 square miles, of which less than 1 per cent. has yet been explored.—(*U.S. Com. Rep., Feb.* 28, 1919.)

Future of the Italian Iron Industry.—A memorandum issued by the Italian Metallurgical Association points out that the needs of the metallurgical industry will exhaust the home iron ore reserves in a comparatively short time, and that it is therefore necessary to import raw and half-manufactured materials. The Elban deposits, which in the past have yielded the bulk of the home supply of iron ore, are now so far exhausted that it is necessary to exploit veins under the sea at greatly increased costs. The Italian reserves are estimated as follows (metric tons) :—Traverselle, 1,000,000; Cogne, 5,000,000; Central Italy, 2,000,000; Sardinia, 6,000,000; Val Brembana, 20,000; making a total of about 14,000,000 tons. The present consumption of ore is about 700,000 tons per annum, and at this rate the whole of the iron ore will be exhausted within 20 years.—(*U.S. Com. Rep., Feb.* 20, 1919.)

Developments in the Peat Industry.—The working of peat as a substitute for coal is extending greatly in many countries, and notably in Austria, where a limited company with a capital of one million kroner has recently been formed to exploit the peat deposits at Salzburg and to work up the by-products. Peat from 2000 localities in Hungary has been investigated, and the calorific values were found to range from 1100 to 4800 calories. In Switzerland, where it is hoped that peat may be used for 18 per cent. of the yearly requirements of fuel, the Peat Association founded in 1917 has obtained a loan of 5 million francs from the Federal Council. English coal has been replaced in Sweden by wood and by peat, of which 120,000 tons was dug in 1916. The yearly output may be raised in the future to 400,000 tons, which would correspond in calorific value to 180,000 tons of coal. In Denmark the output of air-dried peat was 22,000 tons in 1916 and 56,000 tons in 1918. Trials in Denmark of mixtures containing peat as fuel for locomotives are said to have given favourable results. The investigation and development of the extensive Irish deposits is backward although the yearly consumption of peat in Ireland is at least 5½ million tons.—(*Z. angew. Chem., Mar.* 18, 1919.)

Use of Molybdenum during the War.—The war had a marked effect in stimulating the production of molybdenum. On the outbreak of hostilities, the price of molybdenite suddenly rose, and in a remarkable degree, the reason apparently being that Germany, aware of the impossibility of laying up enough tungsten, was buying molybdenite to take its place. England and France also had recourse to molybdenum in the production of high-speed steels. The French used molybdenum in the breech-blocks of some of their field guns, but never, it appears, in shells, armour-plate or gun-linings. Later in the war, it was proposed to make armour-plate containing molybdenum, and contracts were entered into in America to produce such plate. Steel companies were parties to large contracts for molybdenum; but before the steel was actually put to use the war ended. One of the companies concerned used molybdenum, to the extent of less than 1 per cent., in making crank-shafts and connecting rods for Liberty motors.—(*Eng. and Min. J., Mar.* 15, 1919.)

Ramie for Textile Manufacturers.—United States inventors have lately devised means by which ramie can be spun in ordinary cotton machinery, whereby a round, smooth and even yarn is obtained. Prof. J. Rossi, of Naples, has discovered and patented a method by which china grass or ramie fibre can be retted without the use of any chemical agents, which at times have a tendency to injure the natural strength. When chemically degummed ramie is manufactured in combination with cotton, and dyed and printed, the resulting goods possess a novel silky lustre, while the colours show up clearly and brightly on both fibres. The dyes which serve for cotton serve equally well for ramie.—(*Manchester Guardian*, May 7, 1919.)

Proposed Socialisation of the German Chemical Industry.—The socialisation of industry and its application to the chemical industries is a prominent demand of the German socialists, although the proposal cannot be said to have been clearly thought out in its ultimate effects by the mass of German workers. In these unsettled times it is difficult to subject this socialistic idea to calm and unbiassed criticism, but Prof. H. Grossmann, in an article published in the *Zeitschrift für Angewandte Chemie* (March 18, 1919), has pointed out some of the dangers to the workers themselves which would follow its immoderate application to the delicate organisation of industries which are affected by foreign competition. One of the socialist theorists, Karl Kautsky, has formulated a definite scheme for the carrying out of the proposal. He recognises that increased production is one of the most urgent of present day needs, and an essential condition of the success of any socialistic experiment. At the same time he regards the introduction of socialisation as the most important task of the new German State. The means by which this is to be realised involve the creation of "compulsory syndicates" for those branches of industry which are not yet ripe for immediate socialisation, among which it would appear that the chemical industries would be included. The syndicate would be concerned with the procuring of raw materials and the disposal of the products, as well as the regulation of the conditions of production. It would also have the right to close down superfluous or unfavourably situated factories. Its management would be composed of equal numbers of representatives of the employers, the workers council, the organised consumers, and State officials. Prof. Grossmann describes such an organisation as a debating society, and shows how doubtful would be its capacity for attracting and applying the best abilities to the technical and commercial problems of a large industry. Kautsky proposes in addition that in the individual factories committees of workers should be established side by side with the employers' management to supervise the carrying out of the decisions of the syndicate and watch the interests of labour. To such committees members would be eligible who are independent of the factory organisation, such as doctors and officials of trade unions. At the best the working of such a scheme would lead to a multiplicity of counsels which could not be favourable to the peaceful development of the industry, since all decisions would be the result of difficult compromises between conflicting points of view. At the worst it would give rise to intrigues and cabals resulting in unrest and disintegration. Independent investigation and invention, upon which the progress of the industry is based, would tend to be suppressed, and emigration of the best and freest German intellects would be stimulated as in the times following the crises of 1815 and 1848, when similar restrictions on liberty of thought and action were the rule. With regard to the fully nationalised industries, the proposal provides for a decentralised management of the State factories, each being self-controlled. The representation on the boards of management would be in equal thirds as between the State, the workers and the consumers. It is recognised that the interests of the workers and the consumers are opposed, and that such opposition can only be reconciled by increased productivity, this motive being established as a substitute for the profit-earning stimulus under existing capitalistic conditions. Although Kautsky contemplates the compensation of the expropriated owners, this would be effected on the basis of the present value of the material assets taken over and the profit-earning capacity of the undertakings, which has fallen to an extraordinarily low level as the result of the Revolution. No recognition is to be paid to the efforts of scientific and technical men, which have made the German industry what it is, and of which all chemists, engineers and business men are justifiably proud.

Nitrogen Fixation in Germany.—In an article on the development and future prospects of the German atmospheric nitrogen industry, it is stated that at the outbreak of war Germany had in stock 100,000 tons of Chilean nitrate and 430,000 tons of ammonium sulphate. After the battle of the Marne, the Government decided to expand greatly the production of synthetic ammonia and advanced 30,000,000 marks to the Badische Anilin u. Soda Fabrik for this purpose. This firm was able eventually to increase its output of ammonia to 300,000 tons, using the Haber process. Other firms were active developing the Frank-Caro (cyanamide) process, and by the end of 1915 the Berlin-Anhaltische-Maschinenanbau A.-G. had erected 30 plants with a total monthly output of 100,000 tons of nitric acid. In the spring of 1915, when there was only one Haber plant—at Oppau—in operation, the cyanamide producers, backed by the Deutsche Bank, tried to induce the Government to protect the new nitrogen industry by granting a trade monopoly. Objection was raised to this proposal, especially by the Badische company, it being urged that a monopoly would only bolster up the unprofitable cyanamide industry, and that this firm would in a short time be able to supply all the ammonia required without any State assistance. Although the idea of a trade monopoly was abandoned, the Government decided to undertake the manufacture itself by the Frank-Caro process, and hundreds of millions of marks were invested in plants at Wittenberg, Chorzow, and Piesterloh. The Badische firm, with State assistance, also erected a very large works at Leuna bei Merseberg, in which 50,000,000 marks was invested. It would undoubtedly have been better for Germany if the Government factories had installed the Haber instead of the Frank-Caro process. However, this fact is not likely to have any appreciable effect upon the prospects of the German nitrogen industry from the point of view of foreign competition, since the cyanamide process is used in most foreign factories, the Haber process having not yet been fully worked out.

The prospects of establishing an export trade are not unfavourable. Germany's consumption of nitrate before the war was 750,000—800,000 tons, and it is estimated that she can now produce considerably more than this, and will therefore probably be in a position to export; but the great question is whether the industry will be able to hold its own against Chilean nitrate in normal times. The American market will probably be lost, but so great will be the world's demand for fixed nitrogen that there will be no difficulty in finding other outlets for the German products. Meantime it is to be noted that the State works at Chorzow has had to close down for lack of coal, and that labour conditions are very unsettled. On the other hand, it is significant that the Badische plant at Leuna is being enlarged.—(*Z. angew. Chem., Mar.* 21, 1919.)

Foreign Dyes in Siam.—The following figures show the imports of foreign dyestuffs into Siam in recent years:—

	Metric tons 1914–15	1915–16	1916–17
Aniline dyes	48·1	19·9	46·5
Indigo	98·6	267·5	365·3
Other dyes	61·5	44·1	30·5

—(*Z. angew. Chem., Jan.* 24, 1919.)

PARLIAMENTARY NEWS.

HOUSE OF COMMONS.

Scientific and Industrial Research.

In reply to Lieut.-Col. Malone, Mr. Shortt stated that certain decisions have been reached which provide for the extension of the functions of the Committee of the Privy Council for Scientific and Industrial Research, but no decision has yet been made with regard to the establishment of a separate Ministry of Research. This question is still under consideration.—(*May* 8.)

Spelter Production.

The Financial Secretary to the Ministry of Munitions (Mr. Hope), answering Mr. Holmes said that the Government has been buying the total British spelter output during the war. The purchase price was fixed at £56 per ton, but was raised to £60; the selling price was not increased because the average sale price of £57 per ton showed a clear average profit to the Ministry. Since February 3 last, the selling price has been falling and is now £38. This does not involve a loss to the Ministry, because it is supplying concentrates to the smelters at a price based on a £56 value for spelter. At the moment, the smelters are making no profits. By a decision of the Cabinet, the contracts have been continued until November 5 next.

The terms of the contract made in April, 1918, between the Government and the Zinc Producers Association Proprietary, Ltd., of Australia, provided for the purchase by the former of certain stocks of concentrates together with the whole Australian output (less certain reservations) controlled by the Association, for the period of the war and ten years thereafter, subject to maxima of 250,000 tons a year during the war and the ensuing twelve months, and 300,000 tons a year thereafter. The purchase is at a flat price for the war period and five years thereafter, with provision as to division of profits on resale of a part of the quantities taken; for the remaining period it is based on the average London market price of spelter, but with a guaranteed minimum.—(*May* 8.)

The sum of £510,000 debentures has been advanced by the Government to the National Smelting Co., Ltd. The shareholders have paid 1*s*. per share on 500,000 shares, leaving 19*s*. per share uncalled. The whole position is being considered by the various Government Departments.—(*May* 19.)

Electricity Supply.

The Government Bill to provide an abundant and cheap supply of electricity was moved by the Home Secretary and read a second time. The measure provides for the appointment of five Electricity Commissioners, appointed by the Board of Trade, to conduct the whole of the policy dealing with the electrical industry—"to make experiments, to stimulate, to encourage, and to guide"—and to be assisted by advisory boards. The country will be divided into districts, each of which will have an Electricity Board, representative of the local authority, electricity undertakers, consumers and labour. These boards will acquire the generating stations and main transmission lines within their areas, but the machinery of distribution will remain in the hands of existing undertakers; they will, further, provide revenue and expenditure, borrowing money, if need be, from the National Exchequer through the Commissioners, but not exceeding £25,000,000 in the aggregate. The Commissioners may also advance up to £20,000,000 during the period in which the district boards are being set up. The prices charged for electricity will be such as are sufficient to cover expenditure on income account (including interest and sinking fund charges), with such margin as the Commissioners may allow.—(*May* 14.)

Saccharin.

The Chancellor of the Exchequer informed Mr. D. Herbert that saccharin is included among the articles in respect of which Imperial preference will be granted.—(*May* 12.)

German Caustic Potash.

Sir R. Cooper asked if the Soapmakers' Federation is offering German caustic potash, 90—92 per cent., at £100—£105 per ton; if a price exceeding £40 a ton renders this material impracticable for general consumption; and what effect this policy of aiding Germany to dispose of her produce at inflated prices would have on the value of the indemnity to be paid by her.

Mr. Kellaway replied that a proposal on the lines suggested in the question is now under consideration by the Board of Trade in conjunction with the Ministry of Munitions, but no decision has been reached.—(*May* 22.)

REPORTS.

PULVERISED COAL.

PULVERISED COAL SYSTEMS IN AMERICA. *By* L. C. HARVEY. *Special Report No.* 1, *Fuel Research Board. Department of Scientific and Industrial Research. (H.M. Stationery Office. 2s. 6d. net.)*

In pulverised fuel plants, the fuel is injected into the furnace in a finely divided form and is mixed with the correct volume of heated air prior to combustion. In Great Britain the process has been developed principally in connexion with the Portland cement industry in which its use has largely superseded that of other forms of fuel. On a limited scale, pulverised coal has been employed by the Admiralty for steam raising in land boilers. In the United States the process is applied to over 10,000,000 tons of coal per annum, and the present report details the results of a personal investigation by L. C. Harvey into the use of such pulverised fuel in that country. Gas-works' coke and breeze are unsuitable for use in a pulverised form, but pitch can be satisfactorily pulverised and employed. A certain amount of bituminous coal may, if desired, be mixed with anthracite and pulverised. Bituminous coal containing up to 30 or 40 per cent. of ash may be satisfactorily burnt in the pulverised form. The water content of lignites and peat need not be reduced below 5 per cent. for efficient burning in powdered form. The average total cost of pulverising in plants of 50 tons capacity per 24 hours, expressed as cost in coal of the coal pulverised, is distributed as follows:—Equipment 13·25%, drying 5·75%, pulverising 20·00%, and conveyance 4·00%, making a total cost of 43·00% of the coal pulverised.

The general pulverising installation embraces (1) the preliminary crusher wherein the coal is broken down to ¾ in. mesh, (2) the first elevator, (3) the magnetic separator, (4) the crushed coal bin, (5) the driers wherein the coal is dried to within 1 per cent. moisture content, (6) second elevator, and (7) the pulverising mills, those most generally installed being the "Fuller," the "Raymond," and the "Bonnot." The standard fineness of pulverisation adopted is 85 per cent. through a 200 mesh screen (40,000 holes per sq. inch) and 95 per cent. through a 100 mesh screen. The coal dust is conveyed to the burners by means of mechanical conveyors, or by means of compressed

air systems. The risk of spontaneous combustion of the coal is negligible if the store of crushed or dried coal does not exceed that necessary for two-days working. The limit of storage of pulverised coal at the mill house should be a 24 hours' supply, and that at the furnace eight hours' supply. The limit of height of the coal pile should be 10 to 12 feet, and the pile should be isolated from all sources of heat. Various forms of burner, operated by air supplied at a pressure of from 2 to 8 oz. per square inch, are available. A low-pressure air supply is recommended. For open hearth work, however, the fuel is ejected from the supply bin by compressed air at 60 to 80 lb. per sq. inch, preheated low-pressure secondary air being subsequently introduced at the burner nozzle.

Details are given of the use of pulverised fuel in various industries. These embrace (1) Metallurgical processes. In copper smelting a fuel ratio equal to 7·24 tons of copper per ton of pulverised coal has been obtained for continuous work. The following table gives the consumption of powdered fuel in the various operations of steel production :—

Operation	Weight of powdered fuel per ton of steel
Open hearth melting ...	500 lb. per gross ton of ingots cast
Soaking pits	190 lb. per ton (3300 lb. ingots)
Continuous billet-heating	125–140 lb.
Heating steel to forging temperature	458 lb.
Bushelling	450 lb.
Rolling	500 lb.
Puddling	1200 lb.
Annealing (sheet etc.) ...	290 lb. per ton of finished plate

(2) Steam raising. Results obtained by the Missouri, Kansas and Texas Railway indicate an evaporation of from 6·38 to 9·06 lb. of water from and at 212° F. per lb. of powdered fuel. (3) Railway locomotives. A saving of fuel of from 20 to 40 per cent. appears to be possible by the use of pulverised fuel in place of the more usual form. The advantages are stated *in extenso*, and indicate this field as one rich in advantageous possibilities for the use of pulverised fuel. Hitherto, little application of pulverised fuel has been made to marine propulsion or domestic heating.

The author concludes that the advantages of burning fuel in pulverised form have been definitely established, an economy of from 20 to 50 per cent. being established in many cases. On the other hand no economy is to be effected by the introduction of pulverised coal burning apparatus in substitution for existing efficient mechanical stoker installations, but for initial installations the latter plant can be introduced at a lower cost and will show increased overall economies over mechanical stokers. It is also noteworthy that waste coal can be used to good purpose, and that the new system involves a reduced demand for labour, this being particularly marked in the firing of railway locomotives. Useful appendices enumerate (1) the systems investigated, (2) the installations visited, (3) pulverised fuel users, and (4) a comprehensive bibliography.

REPORT TO THE BOARD OF TRADE BY THE FUEL RESEARCH BOARD ON GAS STANDARDS. [*Cmd.* 108, 1*d.*]

The report embodies the recommendations of the Fuel Research Board in reply to a request by the Board of Trade and other Departments that they should advise as to "the most suitable composition and quality of gas, and the minimum pressure at which it should be generally supplied, having regard to the desirability of economy in the use of coal, the adequate recovery of by-products and the purposes for which gas is now used." It is recommended that gas undertakings should be in a position to select those coals which can be drawn from the nearest centres of population. The charge to the consumer is to be based on the actual thermal units contained in the gas passed through his meter. More than one quality of gas may be supplied by a gas undertaking, but the following stipulations refer to all such separate supplies. The gas undertaking is to declare the calorific value of the gas it intends to deliver, and is to adjust consumers' appliances so that the gas may be burnt with efficiency and safety. Should the gas undertaking desire to alter its declared calorific standard, due notice is to be given to the consumers, whose appliances are to be adjusted to ensure safety and efficiency in use of the new supply. The gas is to be free from sulphuretted hydrogen, and the percentage of inerts is not to exceed 12 per cent. The minimum pressure is to be 2 in. of water at the meter outlet. Some relaxation of these requirements may be permitted when the gas is supplied exclusively for industrial use, the products being discharged in the open air, 10 feet or more above the level of adjoining roofs. The more complete removal of sulphur compounds and cyanogen compounds is strongly urged. It is suggested that burners should be standardised for use with gas supplies of respective calorific values 400, 433, 466 and 500 B.Th.U., suitable aëration adjustment being provided whereby the burner may be employed with any quality of gas comprised within successive numbers of this scale of calorific values.

COMPANY NEWS.

BRITISH COTTON AND WOOL DYERS' ASSOCIATION, LTD.

The 19th annual meeting was held at Manchester on May 21. Mr. A. Hoegger, who presided, referred to the position of the dye industry. Statements in the Press and advertisements of certain colour manufacturers tend to give the impression that most colouring matters are now available to dyers; but this is far from being the case. Whilst acknowledging the immense efforts that have been made by the dye makers, it must be admitted that, on the whole, the results have been rather disappointing. Common colours are in ample supply, but more faster colours and a much greater variety of different classes of dyes are still needed. In the cotton section dyes of the indanthrene and algole types are still much wanted, and, amongst others, azoic colours, diazo and benzo fast colours may be mentioned. In wool dyeing the situation on the whole is more favourable, although blacks of the Diamond Black PV type are scarce and at a comparatively high price. Dyes such as patent blue, alizarine cyanine green, and alizarine irisole are also in request. Much success has been achieved in the laboratories, but there is not yet sufficient large-scale plant to meet the requirements of the trade.

The trading profit for the year ended March 31, 1919, is £149,159, and the net profit £85,154 (issued capital £387,083 and £620,000 4 per cent. debentures). A dividend of 10 per cent. is declared on the ordinary shares, £50,000 is allocated to reserve (bringing that fund to £250,000), and the carry

forward is £40,260. Liquid assets amount to £679,400, and creditors' claims £180,600. With regard to the present position, the slubbing and woollen branches are fairly well employed; the cotton branches are still moderately occupied and new business is gradually coming round. There has been considerable improvement in the Indian trade during the last few weeks, and, generally speaking, the outlook for the current year is distinctly favourable.

NEW REGISTRATIONS. — *Maguire, Paterson and Palmer, Ltd.*—The following firms engaged in the manufacture of matches have combined to form a new company:—Maguire, Miller and Co. (Liverpool), Ltd., Maguire, Miller and Co. (Leeds), Ltd., Paterson and Co., of Dublin, and J. Palmer and Sons, of London. The new company, to be known as Maguire, Paterson and Palmer, Ltd., is a private one with a capital of £500,000, with registered offices at Liverpool. Vickers, Ltd., and Tillotson and Son, Ltd., cardboard manufacturers, are financially interested in the new company; match-making machinery will be manufactured at the Erith works of the former. A new match factory is to be erected in Liverpool.—(*Fin. Times, May* 8, 1919.)

The Chemical and Metallurgical Corporation, Ltd., has been formed with a capital of £1,200,000 to acquire the rights of Mr. Frank E. Elmore in respect of inventions for the treatment of complex zinc, lead, and silver ores.

The United Premier Oil and Cake Co., Ltd., has been registered with a capital of £1,500,000 to acquire the shares and business of Wray, Sanderson & Co., Ltd., the Premier Oil Extracting Mills, Ltd., Sowerby & Co., Ltd., John L. Seaton & Co., Ltd., and Universal Oil Co., Ltd. The business to be carried on is that of seed and bone crushing, oil extracting, manufacture of oil, fatty acids, glycerin, soap, etc.

The British Cocoa and Chocolate Co., Ltd., has been registered with a capital of £2,500,000 in £1 shares. The new company will acquire all the ordinary shares of Cadbury Bros., Ltd., and all the "A" and "B" deferred ordinary shares of J. S. Fry & Sons, Ltd.

NEW ISSUES.—*Jurgens, Ltd.* This company was formed in 1914 to take over the business in the United Kingdom of the Dutch undertaking, Anton Jurgens' Margarine Works. It possesses a large factory at Purfleet, on which over £500,000 has been expended, and which it is now proposed to enlarge and complete. The capital of the company is £4,000,000, half in 7 per cent. guaranteed cumulative participating preference shares and half in £1 ordinary shares. Of the latter, £1,000,000 has been issued to the parent company, and £1,000,000 preference shares have recently been offered to the public at par, and the issue has been fully subscribed.

William Gossage and Sons, Ltd., is offering for public subscription at par, £750,000 in 6½ per cent. cumulative preference shares at par, forming part of the £2,000,000 new capital recently created. The nominal capital is now £2,950,000.

THE directors of the Swiss Society of Chemical Industry in Basel have recommended a dividend of 27½ per cent. for 1918, and an increase in the capitalisation of from 12·5 to 15·6 million francs.

THE Metallgesellschaft of Frankfort is to raise its capital from 18 to 21 million marks by the issue of three million marks of 5 per cent. preference shares, to be taken up by the Metallbank. This transaction will effect a closer co-operation between these two bodies.—(*Z. angew. Chem., April* 22, 1919.)

OFFICIAL TRADE INTELLIGENCE.

(*From the Board of Trade Journal for May* 8 *and* 15.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 73, Basinghall Street, London, E.C. 2, from firms, agents or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

Locality of Firm or Agent	Materials	Reference Numbers
British India ..	Iron or corrugated sheets	881
" ..	Metals, soap	885
" ..	Oils, varnish, paint, rubber	887
Canada	Pharmaceutical products including glassware ..	820
"	Acetate of lime, aluminium sulphate	*
Egypt	Caustic soda	828
Austria (occupied)	Copper sulphate, tanning materials, oils and oil seeds	829
Alsace-Lorraine	Chemicals, drugs, oil ..	902
Argentina ..	Galvanised sheets, tinplate, cement, chemicals, drugs	903
Belgium ..	Linseed-oil cake ..	830
" ..	Tin, aluminium, copper, brass, iron, steel ..	840
" ..	Leather, dressed and undressed	912
" ..	Oils, fertilisers	920
" ..	Leather, soap, perfumery	921
" ..	Cattle food, fertilisers, pharmaceutical accessories	†
Brazil	Chemicals, drugs, cement, glass, paints, varnishes	923
France	Asbestos	849
"	Paper	853
"	Chemicals, paper, sugar, alcohol	856
"	Tinplate	858
"	Chemicals, drugs ..	930
" (Algeria)	Chemicals, drugs, paints, varnishes, leather ..	862
Italy	Scientific apparatus ..	865
Mexico	Chemicals, drugs, varnish	867
"	Dyes, paints, varnishes	935
Morocco ..	Mineral oil, glass, soap ..	870
Scandinavia ..	Caustic soda, soda ash, bleaching powder ..	942
"	Textiles, paints ..	943
South & Central America ..	Chemicals, paper, soap, perfumery	945
Spain	Dyes, tanning materials, fine tanned skins, fish oils, greases	878
Switzerland ..	Chemical and pharmaceutical products ..	948

* Canadian Government Trade Commissioner, 73, Basinghall Street, E.C. 2.

† Belgian Section, Department of Overseas Trade, India House, Kingsway, W.C. 2.

TARIFF. CUSTOMS. EXCISE.

Australia.—Cartons and zinc cups for use in the manufacture of dry electric cells may no longer be imported.

The proclamation of August 9, 1916, prohibiting the import of soap from all countries except the U.K. has been revoked as from December 18, 1918.

Canada.—The import duty on formaldehyde is fixed at 20 per cent. *ad val.* under the British Preferential Tariff, and at 25 per cent. under the Intermediate and General Tariffs. In addition there is leviable a war tax of 5 per cent. and 7½ per cent. *ad val.* respectively.

France.—Raw sugar of foreign origin may now be imported for refining on the express condition that re-exportation is guaranteed.

New Customs decisions affect dental pastes containing a minute amount of saccharin, and zinc sulphide.

France (*West Africa*).—The Customs duties on sugar, syrups, chocolate, alcohol, petroleum, salt and matches have been modified.

Japan (*Corea*).—The consumption tax on sugar, molasses and syrup has been modified.

Netherlands.—The Customs and Excise duties on spirits have been increased.

Panama.—The export duties on, *inter alia*, ores, coconuts, copra, balata, rubber, sarsaparilla, ipecacuanha root and copaiba gum have been modified.

South West Africa.—The Customs and Excise duties on certain spirits have been increased.

Tunis.—The import duties on mineral oil and spices have been modified

GOVERNMENT ORDERS AND NOTICES.

EXPORTS.

The following relaxations on existing export prohibitions have been announced :—

Headings transferred from one list to another.

From List A to List B:—

Potassium permanganate.—(May 8.)

From List A to List C:—

Iron ore; malt extract and preparations containing; silk yarn, artificial.—(May 8.) Copper and alloys of copper; copper ore; regulus, matte, concentrate and precipitate; iron pyrites.—(May 22.)

From List B to List C:—

Henbane.—(May 8.) Barium sulphate.—(May 22.)

Altered Headings.

(A) Cocoa, raw, and manufactures thereof, except cocoa-butter and cocoa powder; (C) cocoa powder. —(May 8.)

Iron and Steel.—The Board of Trade announces that nearly all forms of iron and steel have now been transferred to the "free" list; but iron ore and steel containing tungsten or molybdenum are on List C.

Coal.—The Board of Trade proposes to terminate the system of limited prices at present in operation in the case of coal shipped to Allied countries.

Czecho Slovakia.—Goods may now be shipped to this country *viâ* Hamburg and the Elbe, under certain conditions.

IMPORTS.

General licences have been issued permitting the importation of the following articles :—Cocoa butter; oleo stearin; olive oil; articles of food containing sugar; soap and soap stock; medicinal bulbs and herbs. Zinc oxide is to be admitted up to 50 per cent. of importations in 1913.

NEW ORDER.

The Nitrate of Soda (Suspension) Order, 1919. Ministry of Munitions, May 13.

The Flax (Irish Crop) Order, 1919. Ministry of Munitions, May 23.

The Machine Tool, Wood-working Machinery and Treadle Lathes (Suspension) Order, 1919. Ministry of Munitions, May 23.

NOTICES.

The Board of Trade has given notice revoking, as from May 7, the Motor Spirit and Lamp Oil (Maximum Retail Prices) Order, 1918, the Petroleum Products (Wholesale Prices) Order, 1919; and the Motor Spirit Delivery Order, 1918, together with the Orders of February 6, 1917, and July 13, 1917, as from May 17.

The Minister of Munitions has given notice cancelling the Imported Flax Seed (Control) Notice, 1918, as from May 23.

Notice is given by the Privy Council that it is proposed to exempt dinitrophenol from the provisions of the Explosives Act, 1875.

LEGAL INTELLIGENCE.

FIRE AND EXPLOSION AT A TNT FACTORY. CLAIM AGAINST INSURANCE COMPANIES. *Hooley Hill Rubber and Chemical Co., Ltd.* v. *Royal Insurance Co., Ltd. and Others.*

In the King's Bench Division on May 8, Mr. Justice Bailhache heard a special case arising out of an arbitrator's award in a claim by Hooley Hill Rubber and Chemical Co., Ltd. of Ashton-under-Lyne, against the Royal Insurance Co. and three other insurance companies.

The award of the arbitrator stated that on June 13, 1917, a fire broke out in the TNT works belonging to the assured at Ashton-under-Lyne which burned fiercely for some 20 minutes, doing great damage, after which an explosion took place which shattered the premises. The total loss sustained in consequence of fire and explosion amounted to a sum far in excess of the aggregate amount of the sums insured by the policies. The insurance companies admitted liability to indemnify the assured for the loss sustained in consequence of the fire, but disputed liability, under the policies, for the loss consequent upon the explosion. The assured claimed to be indemnified on both counts on the ground that the explosion was an incident in the course of the fire and that the fire was the proximate cause of the whole loss. The arbitrator held that the contention of the insurance companies was well founded. The assured contended further that the insurance companies were estopped from denying that they were liable under the policies to indemnify the assured against loss which arose from the explosion. Evidence was laid before him in support of this contention as against the Royal Insurance Co. only. The negotiations were conducted by correspondence with the Manchester agent of this company, who in answer to an inquiry as to the position in the case of an explosion following a fire, replied that in such a case damage would be duly covered by an ordinary fire policy, with the qualification "that the loss or damage as specified in the third condition of the policy would still be excepted." The company understood the letter as a notification that it was covered against loss caused by an explosion following a fire and therefore limited its insurance against loss caused by an explosion following a fire to the policies about to be issued by the Royal Insurance Co. Consequently the insured did not cover themselves by taking out further policies against such loss. Subject to the opinion of the Court, the arbitrator awarded that the insurance companies should pay the following sums :—Royal £5096, and the other three companies £2548 each; if in the opinion of the Court this construction of the policies was wrong and they did in law cover loss caused by explosion following fire he awarded :—Royal £10,400, and the other three £5200 each; if construction of policies was right but he wrongly directed himself on the

question of estoppel, the Royal should pay £10,400 and the other three £2548 each.

Mr. Justice Bailhache said that he was bound by the judgment given in the case of *Stanley* v. *Western Insurance Co.*, in 1868, and he therefore upheld the award of the arbitrator, *viz.*, that the insurance companies were right in saying that their policies did not cover loss caused by explosion under the circumstances obtaining in the present case. As regards the question of estoppel, the letters written by the insurance manager would convey to an ordinary business man of intelligence that such a loss as had happened in this case was in fact covered by the ordinary form of policy. If the statement was a statement of existing fact independently of any question of law, the Hooley Hill Co. would be perfectly right and there would be an estoppel. If it were not for the old case he thought there would be a great deal to be said for the view expressed by the manager. His Lordship agreed with the arbitrator that there was no estoppel. The result was that the award would stand.

TRADE NOTES.

BRITISH.

National Sulphuric Acid Association, Ltd.—This association has been registered as a company limited by guarantee, with an unlimited number of members, each liable for one guinea in the event of winding up. Its objects are to establish the sulphuric acid industry of the United Kingdom on a permanently prosperous basis, commercially and scientifically, having regard to the necessity of its maintenance as a key industry in relation to the needs of other industries (particularly in time of war); to promote the discussion of all questions affecting the interests of the said industry; to create new outlets for the consumption of sulphuric acid; to devise means of disposing of surplus sulphuric acid production; to give effect, so far as lawfully may be, to the recommendations contained in "the report of a Departmental Committee on the post-war position of the Sulphuric Acid and Fertiliser Trades," appointed by the Minister of Munitions in February, 1917; to promote excellence, economy, efficiency and co-operation in relation to the manufacture and distribution of sulphuric acid, etc. Messrs. S. Mount and J. K. Stewart are joint secretaries. The registered office is at 166, Piccadilly, W. 1.

Fertiliser Manufacturers' Association, Ltd.—The constitution of this company is similar to that of the above, and among its objects are to take over the assets and liabilities of the unincorporated association of similar name; to promote the discussion of all questions affecting the interests of acid and chemical fertiliser manufacturers; to promote excellence, efficiency, economy and co-operation in relation to the manufacture and distribution of chemical fertilisers; to suppress malpractices; to carry on the business of acid and fertiliser manufacturers; to act as a trade protection society, etc. Secretary: Mr. J. K. Stewart. Registered office, 70, Fenchurch Street, E.C. 3.

FOREIGN.

Resources of the Dominican Republic (Latin America).—The commercial report for 1918 shows diminished prosperity compared with 1917, although in view of the foreign trade restrictions and shortage of tonnage results are not considered unsatisfactory. Under United States administration the Republic is being systematically developed, and the financial position of the State has considerably improved. The two chief exports are sugar and cocoa, the crops of which were bad in 1918 owing to late rains and disease of the cocoa plant. The value of the sugar exported was £4,600,000, and the cocoa production was only 18,800 tons, the lowest return for many years. There are a number of openings for trade with Great Britain, but a direct steamship service is essential for any great development of British trade. Considerable progress has been made in the building of roads by the Public Works Department. Little is known of the mineral resources, but a company is prospecting and nickel is said to have been found. Oil-boring at Azua has been successful and a small output of 300 to 400 barrels per day is expected.—(*Bd. of Trade J., April* 10, 1919.)

Copra in New Caledonia.—Exports of copra have recently been as follows (tons):—1913, 3215; 1914, 3103; 1915, 2676; 1916, 2283; and 1917, 3661. The colony is very well suited for the cultivation of the palm, and the production of copra on a large scale ought to be organised at once in order to meet the growing demand.—(*Dépêche Col., Mar.* 25, 1919.)

The Japanese Dye Market.—Great depression has ruled in the Japanese dye market since November last. Except for a few local transactions, business is at a standstill; merchants are reported to be endeavouring to cancel contracts, and bankers are extremely cautious in trusting dye merchants. Yellow dyes have fallen in price from 4200 to 1200, and black dyes from 470 to 230 yen per 100 kin (yen = 2*s.*, kin = 1·3 lb.). In some quarters it is anticipated that American competition will be felt more in the South Seas and in China than in Japan itself.—(*U.S. Com. Rep., April* 9, 1919.)

The Perfumery and Essential Oil Trade of Switzerland.—The manufacture of perfumes was started in Switzerland in the 'nineties of the last century. Despite many natural disadvantages, such as lack of raw materials and cheap fuel, it has made rapid headway and a large number of artificial perfumes have originated in the country. The recent economic blockade of the Central Powers, together with the activities of the S.S.S. (Société de Surveillance Suisse), have had an adverse effect on the importation of natural oils and upon the exportation of finished products. Before the outbreak of war the quantity of ethereal oils imported from Germany was more than double that obtained from France, but by 1918 this proportion had become reversed. The exports of synthetic perfumes in recent years have been as follows (in centner = $\frac{1}{20}$ metric ton):—1905, 507; 1913, 2466; 1914, 1920; 1915, 2116; 1916, 2117; 1917, 1395; 1918, 686. Although quantities have declined, values have increased enormously. Thus the exported value of synthetic perfumes in 1913 was 6,181,000 francs, and in 1918 7,220,416 francs; in the latter year the value was ten times greater than in 1900. The following table gives, in centner and francs, the exports of perfumes and cosmetics during the years 1913—1918:—

Year	Exports Centner	Value Fcs.	Destination % *E.C.	N.	C P.
1913 ..	2639	6,936,276	87·7	4·4	7·7
1914 ..	2048	5,938,582	83·9	6·8	9·4
1915 ..	2275	8,375,190	76·6	10·4	12·9
1916 ..	2361	11,125,141	82·0	12·3	5·7
1917 ..	1567	7,842,053	66·8	15·5	17·7
1918 ..	856	7,458,829	82·2	17·5	0·2

*E.C. = Entente Countries, N. = Neutrals, C.P. = Central Powers.

The falling off in exports and production in 1917 was due to Customs' difficulties, lack of transport, the commandeering of nitric acid and benzene for the Swiss army, and to general diminution in trade. As regards the future, Switzerland will have to look more to the East and to the South, more particularly because many of the

countries which formerly took her imports have initiated or developed their own industry. The competition of the United States and Japan will probably be formidable. The Swiss industry must devote its attention more particularly to the manufacture of specialities, *i.e.*, to quality rather than quantity production.—(*Schweiz. Chem.-Zeit.*, 11—13, 1919.)

Chemical Industry in the Netherlands.—An official report, issued in connexion with the Second Annual Utrecht Fair, gives information concerning the development and present condition of many of the natural chemical industries.

Sulphuric acid is manufactured by the Maatschappij van Zwavelzuurbereiding, Amsterdam, and the N.V. Amsterdamsche Superfosfaatfabriek, which has been united with the Centrale Chemische Fabrieken. Both the lead chamber and contact processes are used, though platinum for the latter has had to be purchased at fabulous prices. These two factories and the Lym- & Gelatinefabriek, Delft, produce raw and pure muriatic acid; nitric acid is also made by these firms as well as by Ketjen, the Fabriek van Chemische Producten, Pernis, and Van der Elst & Matthes' Ammoniakfabriek at Weesp.

Little soda, soda crystals or potash is produced; ammonium sulphate is manufactured at gasworks and by distilling organic matter. The N.V. Ammoniakfabriek v.h. van der Elst & Matthes, Weesp, manufactures household ammonia as well as sulphate, carbonate and nitrate. Chloride and phosphate of ammonia are made by the Amsterdamsche Superfosfaatfabriek, Ketjen. The demand for sources of nitrogen is very great, and only 10 per cent. of the requirements of nitrogenous fertilisers are covered by home supplies. Some soda is made electrolytically, together with chlorate of lime.

Chlorate of potash is manufactured by the N.V. Chemische Fabrieken Paludan & Co., Haarlem, and by the N.V. Chemische Fabriek v.h. Dr. F. C. Stoop, Utrecht. The output of superphosphate has decreased owing to the war, and scarcity of sulphate of ammonia has stopped the supply of mixed manures. Fluosilicate of soda, phosphoric acid, potash and soda phosphate, red lead and chloride of sulphur have been produced as by-products. Silicate of soda, the manufacture of which for strawboard is now profitable, is made by the N.V. Chemische Fabriek "Gembo" of Winschoten and the Chemische Fabriek F. C. Stoop. Nitrates of potash and soda are made by the latter firm and bisulphate of soda by the Chemische Fabriek Naarden and Ketjen. The high price of silver prevents the manufacture of silver nitrate. Iodide of mercury from Dutch East Indies' raw material is made by Brocades and Stheeman, white and red lead by the Utrechtsche Loodwit & Meniefabriek G. Greeve, and the Zuid Hollandsche Verffabrieken, and plumbago and sugar of lead by the latter firm. The Maastricht Zinkwitmaatschappij has built a third factory for zinc white and lithopone; ivory black is produced by Wed. P. Smits & Zoon, ultramarine by E. Guimet of Sas van Gent, chrome yellow, zinc yellow, Berlin blue, lime green, etc., by the N.V. Verstoffenfabriek Remmert & Co. of Apeldoorn.

Hydrogen, oxygen and nitrogen are produced by the N.V. Maatschappij Oxynium, Schiedam, the two latter elements also by the N.V. Electro-Zuur- & Waterstoffabriek, Amsterdam. Argon and wolfram wire from the ore are made by Philips & Pope's Electric Lamp Works.

The Nederlandsche Gist & Spiritusfabriek makes 96 per cent. alcohol, amyl alcohol from by-product fusel oil, ether, and ether pronarcose in 50-gram bottles. The Fabriek van Chemische Producten at Pernis makes ether, formic acid and sodium formate. Calcium acetate products are more difficult to manufacture. Lactic acid and calcium- and ferrolactate are made by the N.V. Chemische Industrie Rotterdam.

Government coke ovens will shortly distil much coal tar. The Maatschappij van Koolteerproducten at Krimpen a/d Ysel makes a number of coal tar products, and Pernis and Naarden a variety of intermediates; Naarden produces also saccharin and ethereal oils for perfumes and flavourings. The N.V. Polak & Schwartz make a variety of fragrant and other organic substances, and Polak's Frutal Works, Amersfoort, produce, in addition to other perfumes, solidified cedar oil and ethereal oils free from terpene.

The Societeit voor Chemische Industrie, Katwijk, makes theobromine, sodium salicylate, caffeine and methyl salicylate, the Amsterdam Superfosfaatfabrieken "superol" (orthooxyquinolinesulphate) and "anæsthesine," the Amsterdam Kininefabriek quinine and its salts. Brocades and Stheemann will make dermatol, airol, and cascara.—(*U.S. Com. Rep., Mar.* 13, 1919.)

German Oil Mills Trade Association.—At the annual general meeting of the Bremen-Besigheimer Oelfabriken it was announced that the three largest German oil mills, the Verein Deutscher Oelfabriken of Mannheim, F. Thorl's Vereinigte Harburger Oelfabriken and the Bremen-Besigheimer Oelfabriken had concluded an agreement to form a trade association for the purpose of facilitating sales and purchases. Other large oil mills are expected to join in the scheme.—(*Seifenfab., Mar.* 5, 1919.)

REVIEWS.

Recent Advances in Physical and Inorganic Chemistry. *By* A. W. Stewart, *with an introduction by* Sir William Ramsay. *Third edition. Pp. xv* + 284. (*London: Longmans, Green & Co.*, 1919.) *Price* 12*s*. 6*d*. *net*.

The new edition of Dr. Stewart's well-known book is largely a new work, as is pointed out in the preface. Whilst the first and second editions each contained fourteen chapters, the new edition consists of twenty, of which twelve are quite new and the others, with one exception, have been very considerably revised.

Ten years have elapsed since the book made its first appearance, and comparison of the first and third editions is of considerable interest as indicating the trend of work during the past decade. Attention has been drawn so much to radioactive phenomena and the evolution of the elements that about one-half of Dr. Stewart's book deals with these and kindred subjects, whilst the remainder is devoted to various matters of more or less interest.

Each chapter of the book forms a nearly complete and independent essay, so that the order in which Dr. Stewart deals with the material does not greatly matter, though one is rather surprised at the arrangement. Thus after dealing with electric furnaces, the fixation of nitrogen, the permutites, peroxides and per-acids, active nitrogen and absorption spectra in the first six chapters, the next three chapters are concerned more or less directly with X-ray work, the tenth chapter is devoted to the rare earths, incandescent mantles not unnaturally follow in the next chapter, and then we encounter the pseudo-acids before getting on to the inactive gases. Since each essay is nearly independent, the position of the chapter on pseudo-acids does not much matter, though the reason for its place is not clear.

The phenomena of radio-activity might have been dealt with before presenting work on X-rays and on inactive gases, more especially as the historical method is employed in the chapter on radio-activity (Chapter XV.).

The subjects described in the book have been indicated above, their treatment is generally satisfactory. Scarcity of diagrams is a drawback; that the first two chapters which deal respectively with the electric furnace and the fixation of nitrogen should not contain a single sketch of plant is remarkable. The space given to the permutites is not great (four pages), but one may question whether their theoretical interest is sufficient to warrant their inclusion under the head of recent advances when phase rule, colloids, and co-ordination valency theory are untouched. All these matters received some attention in the first edition, and their present exclusion is to be regretted considering the great technical importance of clear views on the phase rule and of a sound knowledge of colloidal chemistry, whilst the discovery of optical activity associated with the co-ordination compounds of metals, such as cobalt, must certainly be regarded as a very real advance in chemical science.

The chapters on peroxides and per-acids and on active nitrogen are short and to the point, but the treatment of absorption spectra in Chapter VI. leaves something to be desired. The reviewer cannot help thinking that had the subject of pseudo-acids (and bases) been treated immediately afterwards, and attention drawn to the fact that our usual indicators for acidimetry are included amongst these compounds, distinct advantage would have accrued.

The chapters dealing with radio-active phenomena, X-ray analysis, positive ray analysis, disintegration of the elements and kindred subjects are clearly written. Of much that is good, perhaps the best is to be found in Chapters XVIII. and XIX., which deal with isotopes and the elements respectively.

Some of the remarks in the concluding chapter in disparagement of the Ostwald school are unnecessary and uncalled for. That some physical chemists are unfortunately rather deficient in their knowledge of organic chemistry is unfortunately true, equally lamentable is the fact that organic chemists do not always possess a very accurate knowledge of physical and physico-chemical facts and theories.

The reviewer has read Dr. Stewart's book with much enjoyment, and hopes that it will be widely read by others.

J. T. Hewitt.

The Physical Chemistry of the Proteins. *By* T. Brailsford Robertson. *Pp. xv* + 483. *(London: Longmans, Green & Co.,* 1918.) *Price* 25*s. net.*

It is to be regretted that in abandoning the usually accepted hypothesis of protein ionisation Dr. Robertson has given us no effective working substitute, with the result that the treatment of the subject tends to be superficial and even the voluminous bibliography, ill-balanced. The author's contributions to literature are referred to in over one hundred references, whereas only fifty instances cover the allusions to the work of Arrhenius, Bayliss, Mellanby, Michaelis, Sörensen, and Roaf collectively. A redeeming feature, however, in this connection, is the extensive quotation from the work of W. B. Hardy, though an apparent omission to quote or recognise the significance of his work on denaturation and its prevention by preliminary treatment with fat solvents in the cold, is difficult to understand.

Referring more particularly to the parts of the work of immediate interest to those who have protein materials to examine; or to study and control in manufacture, it is to be noted that in the chapter on the preparation of pure proteins only one method is given in each case and allusions to others are scanty. No mention is made of the preparation of pure blood albumin, nor of fibrinogen. The chapter on "Quantitative Estimation of the Proteins" consists of descriptions of a nephelometric method, and a description of how Dr. Robertson himself carries out refractometric determinations with a Pulfrich Refractometer and sodium light, but with no temperature regulation. After reading this chapter it is less difficult to understand the statement on page 60, "The refractometric method does not permit the extreme accuracy which may be attained with the nephelometric method under favourable conditions," which is in accord neither with anticipation nor with general experience. No allusion is made to the standard methods of measurement of protein concentration which have been so skilfully elaborated by Chick and Martin and others, and which must necessarily enter into any computations based on physical methods, except in a few lines on page 70, where they are dismissed with the words, "the direct method of demonstrating the existence of protein compounds cannot be trusted to yield accurate data, and results and conclusions based upon this method are to be accepted with the greatest caution." Under the heading of "The Compounds of Proteins with Oxygen" reference to the work of Barcroft is restricted to twenty lines, and neither in the chapter dealing with the precipitation of the proteins by inorganic salts, nor under the heading, "Compounds of the Proteins with Toxins, Antibodies, Ferments, etc.," is any allusion made to Banzhaf, whose painstaking and persistent advances in this work are marred only by difficulty of access on this side of the Atlantic. The phenomena of the "protection" of hydrosols by protein are alluded to very briefly indeed, and the whole consideration of "isoelectric condition" is confined to one page. Dr. Robertson's own researches have been largely studies of caseinogen solutions, but his views on the explanations of the behaviour in the electric fields have not met with general acceptance.

From the point of view of the research worker in the Physical Chemistry of Proteins, the book should be of value in providing an extensive bibliography, and the touchstone of a different school of thought against which to try his own hypotheses and preliminary conclusions. To the technical chemist wishing to consult a carefully reasoned and accurate source of information it is not calculated to prove of assistance.

G. Stanley Walpole.

PUBLICATIONS RECEIVED.

Biochemical Catalysts in Life and Industry. Proteolytic Enzymes. *By* Jean Effront. *Translated by* S. C. Prescott, *assisted by* C. S. Venable. *Pp.* 752. *(London: Chapman and Hall.* 1917.) *Price* 23*s.*

Applied Optics. The Computation of Optical Systems. *In 2 Volumes. Being the "Handbuch der Angewandten Optik" of* Dr. A. Steinheil *and* Dr. E. Voit. *Translated and edited by* J. W. French. *Vol. I., pp.* 170; *Vol. II., pp.* 207. *(London: Blackie and Son, Ltd.* 1918.) *Price* 12*s.* 6*d. per volume.*

ENEMY CHEMICAL PATENTS IN THE UNITED STATES.

The Report of the Alien Property Custodian in the United States, issued last March, gives a circumstantial account of the machinations and ramifications of the German chemical "octopus" in that country, and of the means adopted to cut its tentacles, thus paving the way for future economic independence. The powerful, highly organised, and ubiquitous German chemical houses not only had under their thumb some $3,000,000,000 worth of American chemical trade—chiefly of the "non-heavy" description—but used their agents as a means of espionage and propaganda on behalf of the German Government. The full report, in so far as it relates to the chemical industry, is given in the April issue of the *Journal of Industrial and Engineering Chemistry*, and those who run may there read a story of intense interest and one whose burthen should be laid to heart by all who are concerned with the welfare of chemical industry in non-German lands. The upshot of the revelations was the seizure, under an Executive Order of the President of the United States, by the Custodian of all the known enemy alien property in the country to a value of approximately £140,000,000 sterling. This property is divided into two classes. The first, consisting of what may be termed investments of a purely honourable business kind, is to be held in trust pending the action of Congress; the second class, covering investments held by powerful industrial corporations pursuing political as well as financial ends, has apparently been seized irrevocably: in the words of the Custodian, "No obligation is owed to their private owners to conserve or care for them with a view to ever returning them in kind."

Among the second class of investments are included the German patents taken over by the Custodian under an amendment to the Trading with the Enemy Act of November 4, 1918. They number about 4500 and cover a wide field, including metallurgy, nitrogen fixation, hydrogenation of oils, etc., but the majority and the most valuable relate to dyes. Many of them were taken out not with a view to manufacturing in the United States, but with the evident intent of blocking American enterprise and of stopping importations from other European countries; and the product patent proved very serviceable in this respect. The former owners are now prospectively to be hoist with their own petard, for it has been resolved to use these sequestrated patents as a means of protecting the nascent American dye industry by preventing the importation of German chemical wares after the war. The introduction of new classes of dyewares has almost invariably followed some years after the original patents covering their manufacture were taken out. As many of the seized patents were dated 1917 or 1918, it follows that the American owners should be able, for some years at least, to keep out any new dyes, etc., with which the Germans may attempt to recapture the American market.

A new corporation, called the Chemical Foundation, Incorporated, has been formed to purchase from the Alien Property Custodian, and hold for the chemical industries and the country at large, the whole of the German-owned United States chemical and allied patents. The company is capitalised at $500,000, of which $400,000 is preferred stock and $100,000 common stock, the dividend on each class being limited to 6 per cent. The preferred stock is subject to redemption as a whole at par on January 1, 1921, or on any first of January thereafter, when the accumulated profits shall have become equal to the total issued and outstanding stock of both classes. In order to prevent unfriendly or sectional interests acquiring control, no stock will be transferable except with the consent of the board of directors, and the underwriters are endeavouring to distribute the stock as widely as possible among the chemical and allied industries. It is the intention that, eventually, no single subscriber shall own more than $1000 worth of stock, $800 preferred, and $200 of common stock, which has the voting power.

One half of the capital is to be paid to the Custodian in purchase of, substantially, all the German dye and chemical patents seized by him. The Foundation will issue non-exclusive licences under them to all Americans whose patriotism and competence are beyond question, and it will take legal proceedings against all persons who attempt to import any infringing product; the second half of the capital, it is understood, will be set aside as a kind of reserve to defray the cost of any litigation. Enemy trademarks taken over by the Custodian are included in the sale, and a plan is being formulated to enable the Foundation to issue licences to American manufacturers to use them, the intention being to issue such licences only when the goods to which the mark is to be attached are proved to be equal or superior to those of the original owner. Further, it is intended to purchase new patents, and the German copyrights covering much of the indispensable literature of science. After the preferred stock has been redeemed, it is proposed to allocate the profits of the Corporation, which are expected to be considerable, to the promotion of research, not by initiating or aiding investigation on its own account, but by effecting close co-operation between existing academic and industrial organisations. To this end one of the first steps will be to take a census of all laboratories, governmental, industrial, and academic, in the country, and to establish a bureau of information which will be accessible to researchers, manufacturers, consumers, and all others genuinely interested. Finally, it has been resolved to press Congress to pass a law for the institution of a licence system governing all chemical importations for a period of ten years.

This practical method of utilising confiscated property to encourage home industry and discourage importations from unfriendly sources demands the serious consideration of interested parties in other Allied lands. Whether the ultimate policy involved —namely the taxation of the consumers of chemicals, chiefly dyes, to promote research that is to benefit chemical industry at large and to provide funds for law costs—is preferable to the alternative of annulling the patents and stopping importation by the existing Customs machinery, is matter for discussion. In the United Kingdom this class of enemy property is also in the hands of the Custodian (the Public Trustee) and licences are granted to British manufacturers practically for the asking. The reticence of the responsible authorities here stands in marked contrast to the refreshing candour with which the corresponding authorities in the United States have disclosed their knowledge and intentions. It would, perhaps, be too much to expect the veil of secrecy to be lifted entirely during the negotiations which are taking place at the Peace Conference; but it must be emphasised that undue official secrecy and procrastination are to be deprecated inasmuch as they tend to keep interested and expert opinion uninformed, thus preventing it from arriving at decisions which may be required promptly when the time for action arrives. By then, chemical industry should be in a definite position to speak with effect, authority, and, if possible, with unanimity.

THE PASSING OF THE AMERICAN POTASH FAMINE.

P. G. H. BOSWELL.

The statement made recently in the public Press that 30,000 tons of German potash is to be delivered to this country in exchange for food suggests that the "opportunist" methods of obtaining potash during the war did not yield supplies equal to the demand. A similar delivery of potash to America is also foreshadowed, so that, despite the statements of the newspapers during the war that the potash problem had been solved for all time, it would appear that the current is again setting in towards the use of natural potash salts. The situation as regards potash in America as well as in this country before and after the signing of the armistice presents many points of interest, a few of which are here considered.

The National Exposition of Chemical Industries held in New York in September last was a powerful vindication (if such were needed) of the claim that applied science played a great part in the successful prosecution of the war. The Exposition was in many respects similar to the British Scientific Products Exhibition which was held a little earlier in the year at King's College, London. To proceed from the one to the other was most instructive. The smaller British Exhibition showed more of the part played by the scientist and man of research; the huge American Exposition indicated less the resourcefulness of the individual and more of the wonderful development in the industrial application of science. It was, in short, a magnificent advertisement of the vast American enterprise in applied chemistry and chemical engineering evolved by the stress of war.

The difference in attitude of the two organisations was shown by the character of the lecturettes: in England these were given mainly by distinguished scientists and dealt with recent advances in applied knowledge; in America they were mostly delivered by works' superintendents, chemists, and others, who concerned themselves with corresponding progress in industrial methods and applications. It was but fitting that part of the Exposition and several of the lecturettes should be devoted to the difficult and important problem of potash-supply. The speakers contented themselves with a description of the respective sources of potash, such as kelp, cement-kiln dust, alunite, the Searles Lake and Nebraska liquors etc., and with pointing out that such sources would be only sufficient to supply the needs of certain individual industries like the manufacture of chemicals. The total production had been 50,000 tons for the year, as against 230,000 tons imported before the war. Nevertheless, certain of the speakers were credited in the Press on the following day with having declared that nevermore would it be necessary to obtain potash-salts from Europe!

During the period immediately preceding the Exposition, the glass industry, and in part, the chemical industry, in America had been using considerable quantities of Russian potash. Besides that imported by private merchants, 4000 tons of carbonate of potash from Russia was imported into America in 1917 by the Russian Government. It is said that the responsible authorities desired to dispose of the stock in one lot, the figure of $3,000,000 being mentioned. Supplies were also imported into America by enterprising merchants, who, after the closing of the Black Sea, succeeded with great difficulty in getting the potash transported to Archangel. The supply arose out of the fact that the peasants in southern Russia depended almost entirely upon the sunflowers for their fats for edible and other purposes. Large quantities, therefore, were grown, and the ashes, comparatively rich in potash, which resulted from the burning of the stems, flowers, and seeds, were collected at intervals and taken to a depôt. The potash was leached out, the liquor evaporated down, and the resulting white carbonate packed into barrels of rather over 1000 lb. each. In many cases the degree of purity of the product was noteworthy. Large quantities contained (excluding moisture) over 96 per cent. of carbonate; potassium chloride formed less than 2 per cent., the sulphate less than 1 per cent., and soda, alumina, and silica were practically absent.

Serious difficulties were experienced in transporting the barrels from southern Russia to the northern ports. The railways were often too congested to be available and recourse had to be made to road haulage, portage on rivers, etc., and even to hand labour. When, however, the potash eventually reached its destination in New York, the price it commanded was sufficient compensation for all the trouble and expense of its transport. In March 1916 the high-grade material of 96—98 per cent. carbonate was eagerly sought at 90 cents per lb. In March 1918, owing to the arrival of further consignments *via* Archangel, the price had fallen to 35 cents. Last autumn, before the armistice, it was selling at 30 cents, and to-day it goes begging in New York at 15 cents.

In 1917 and 1918 the importation of Russian potash was only about half the normal (about 10,000 tons). The 4000 tons imported by the representatives of the Russian Government did not relieve the situation to any great extent, for their attempt to sell the consignment entire was not successful. Much of it was second-grade material and some was damaged by sea-water. Eventually the highest-grade product was selected and bought by the private importers in New York, such a course being, presumably, dictated only by financial stress.

The 96—98 per cent. carbonate of potash was retailed almost solely to manufacturers of pharmaceutical chemicals. The glass industry took very little, partly no doubt, so far as the manufacturers of optical glass were concerned, on account of the moisture-content. The nitrate was in more general use, but at least one optical firm bought very pure carbonate which had been recrystallised by the importers to free it from sulphates and chlorides. This purified carbonate was accepted as being purer than any pre-war material used in the works. It may be noticed in passing that a claim was made before the armistice that formulæ had been devised which permitted the substitution of soda for potash in optical glasses; a similar claim was made in Britain over two years ago in the case of table and ornamental glass.

Up to a short time before the cessation of hostilities, the export of only a very small quantity of potash for medicinal purposes was permitted from the United States to Britain. But this restriction was ultimately removed through the efforts of Mr. C. Macdowall, who was responsible for potash-control in the Chemical Section of the War Industries Board at Washington. By the time, however, that the larger American supply was available, the situation in Britain had been slightly relieved, for the recovery of potash from blast-furnace flues had begun.

In this connexion it is interesting to observe that, whilst it has been decided on all hands that the recovery of potash from cement-kiln gases and dust in this country is not a paying proposition, the reverse is the case in America. Recovery of potash was already proceeding in Portland cement works across the Atlantic during last autumn, but grave doubt was expressed as to the feasibility of extracting it from blast-furnace gases and dust.

Turning to other American sources of potash, it

is only necessary to say that the activities of the American Trona Company at Searles Lake, California, have too frequently been noticed in this journal to call for repetition here. The salt lakes of Nebraska yielded about one-third of the total American production of potash.

A noteworthy feature of the exposition in New York was the exhibit by the Hercules Powder Co. of chemicals other than potash extracted from the giant kelps of the Pacific Coast. The company owns a huge plant near San Diego, California, and turns out, among a long list of chemical products, ketones (including acetone), ammonium sulphate, acetic acid, and many esters.

As bearing on the probable future demand, it has generally been stated over the East and Middle West of the United States that never again would the soil be so heavily treated with potash manures as previously. The fact that the greater part of the pre-war American import of potash was used for fertilising purposes was regarded as being entirely due to German propaganda work. It is said that crops of potato, sugar-beet, cotton, tobacco, etc. have suffered little, if at all, from the absence of fresh applications of potash. This may well be, but it is of course possible that at present the crops are living upon and exhausting the reserve potash in the soil. That the poor sandy glacial soils of northern Germany should need continual dressings of potash, or that our own soil, at one time probably rich but tilled for centuries until its potash content has been almost exhausted, should require renewal, will surprise nobody. But vast areas of virgin soil in America, much of it rich clay and loam of glacial origin, ought not for many years to require artificial fertilisation with potash.

Since the armistice was signed, the consumption of potash in America has fallen considerably. New York warehouses are full of it, and the Nebraska and Californian plants have suspended operations in the absence of buyers.

The conclusion of peace, settling as it presumably will the question of the future ownership of the Alsatian deposits, will necessarily lead to a reconsideration of the war-time methods evolved in the struggle for potash.

PRESENT-DAY FOOD PROBLEMS.

In his recent Cantor Lectures on " Problems of Food and their Connexion with our Economic Policy " Prof. H. E. Armstrong considered the processes of assimilation and digestion in plants and animals with reference to the special food requirements of man. Attention was particularly directed to the general failure to take into account *quality* as distinct from *quantity* of food; and emphasis was laid on the particular value of fresh and whole foods—on account of the presence in these of certain indispensable but altogether minor constituents (Advitants)—and to the consequent need of devoting our energies, as far as possible, to the production of those foods which it is most desirable to raise on the spot, as they lose value on keeping and when preserved, leaving those which are not subject to this disability—such as wheat—to others, at a distance, where the conditions are such as to favour their production.

Life, in the main, is a geometric process: only materials that will fit into the living structure can be utilised and the patterns followed are strictly limited in type. The peculiarities are to be regarded as the outcome of qualities inherent in the primary vital unit—the carbon atom—and the selection by Nature of a single geometric type of material for her purposes. A carbon atom in association with four distinct and different radicles constitutes a system of which, in the simplest case, two forms are possible: these are asymmetric and are related as an object to its image. Such compounds are always optically active, to equal extents but in opposite directions. We are built only of one of these types of material and can only use this type as food; we should starve on food of the optical sign opposite to that at our disposal. It is clear that Nature builds always with the aid of templates or moulds and that her primary activity is controlled and directed at every stage.

Solid models of the structure of glucose were exhibited which had been constructed by Mr. W. Barlow. Attention was called to the mechanism whereby such structures might operate in determining the assemblage of the separate units in the synthetic production of glucose in the plant from formaldehydrol. The processes of digestion were discussed with special reference to the part played by enzymes, the manner in which these act being illustrated by reference to Urease, Lipase and Invertase. Their nature can only be inferred, as they cannot be dealt with individually; they seem to be colloid materials. Their singular and unrivalled activity, as hydrolytic agents, can only be accounted for on the assumption that they not only fit exactly the molecules which they are able to influence—either wholly or in some particular section—but in some way serve to condition hydrolysis by bringing the elements or ions of water to bear on the particular region of the hydrolyte where scission takes place.

Diffusion phenomena through differential septa were then considered, chiefly with reference to the experiments carried out by Adrian Brown with the aid of barley grains. The nature of the clue these give to the behaviour of anæsthetics generally and of substances such as acetic acid, alcohol and ammonia, which pass readily through all septa which are permeable by water, was pointed out. Substances of this class (Hormones) probably play an important part in stimulating digestion and in inducing changes throughout the system during the period of assimilation. The effects produced by vinous beverages generally were discussed at some length in this connexion and exception taken to the report of Lord D'Abernon's Committee on " Alcohol: its action on the human organism," on the ground of its incompleteness, all reference to recent work on the influence of alcohol, etc., on the course of chemical change being omitted.

Oxidative changes were next considered and a possible mechanism suggested. Oxidation is effected through the agency of the oxygen carried forward in the blood stream in loose combination with hæmoglobin but there is every reason to believe that the oxygen functions simply as a depolariser and is initially converted into hydrogen peroxide—which, however, is not an oxidising agent *per se*: it needs a catalyst to render it active. Attention was directed to the formation of an oxidising " perhydrol " from ferrous sulphate and the peroxide (see this J., 1913, 391; " Studies on Oxidation ": Armstrong and Colgate) and the suggestion was made that a similar process might be at work in cases of selective oxidation in the body.

Assuming that the enzymes are active, in many cases, through the agency of an acid radicle (CO.OH), it is conceivable that they might be convertible into perhydrols (COO.OH) and thereby function as hydroxylating (oxidising) catalysts, at least at the early stage when compatibility of the agent with the substance attacked is a matter of importance. Such oxidising enzymoid catalysts might also indirectly condition reduction—if a sufficiently easily oxidisable substance were included in the circuit.

Hydrogen peroxide is the one agent by which oxidation products may be obtained in the laboratory in agreement with those formed in the animal system, other oxidising agents as a rule giving different products. As most oxidising agents destroy hydrogen peroxide the difference is in no way peculiar. It has been thought to be surprising that fatty acids are so oxidised by hydrogen peroxide and in the body that the attack always takes place at the carbon atom third in the chain, the acid being converted ultimately into one in which the number of carbon atoms is less by two. It was shown that this is the result to be expected, using solid models constructed on the plan followed in representing glucose.

If a sympathetic enzymic mechanism such as that pictured be in any way concerned in the oxidative degradation of glucose, diabetes might be the consequence of its more or less complete destruction; or just as the ferrous perhydrol mechanism is thrown out of action by an oxidising agent, such as permanganate, so some interfering process might come into play and negative its action.

Dealing next with the liberation for use of the enzymic mechanism, the case of *secretin* was considered: as Starling and Bayliss have shown, the enzyme in pancreatic juice is only set free from the intestinal mucous membrane when this is subjected to the action of very weak chlorhydric acid but by a secondary process, through the liberation of the substance they have termed "secretin." It was in connexion with this discovery that they coined the term "hormone." The lecturer wished to confine the use of this term to the large class of chemically active substances, including alcohol and anæsthetics, which act primarily as mechanical disturbing agents and, in virtue of their irresistible penetrative power, not selectively and functionally. He would term secretin and other substances which are the characteristic secretions of various glands *Functional Adjuvants*. A possible way in which one of the most remarkable of these adjuvants, *Adrenaline*, may exercise its regulative influence on the blood stream was discussed.

The food accessories were next brought under discussion and the proposal was made that the term *advitant* should be substituted for *vitamine*, to which exception has frequently been taken. After a discussion of scurvy and Eijkman's observations in Java on Beri-beri, an account was given of the pioneer inquiry of Gowland Hopkins, first published in 1912, and to later work on the subject.

After reference to the evidence that the units of which the proteins are composed are all necessary as structural materials, the various inquiries carried out within recent years were considered, from which it appears that, in addition to the protein educts, a variety of materials of an unknown nature, the *Advitants*, are indispensable contributories to the vital process: in their absence not only is growth stayed but disease sets in and ultimately death. These substances are present in milk and whole foods generally but their distribution is irregular and the proportions in which they occur are subject to great variation. The tendency of modern practice is to favour the use of foods which, if not destitute of these agents, contain them in insufficient quantity; there is little doubt that, during the war, our dietary has not afforded a sufficiency of these constituents, especially during the period when there has been a shortage of milk, eggs, butter and fruit. It is far from improbable that such deficiency has been the unsuspected cause in the past of much disease (especially of faulty teeth) and of malnutrition among the masses. The investigations relating to this subject were fully summarised and their great practical importance emphasised, as well as their bearing on our economic policy.

THE BEARING OF CHEMICAL COMPOSITION AND ITS ACCURATE DETERMINATION ON THE IRON AND STEEL TRADES.

C. H. RIDSDALE.

In the article on Chemical Standards appearing in the issue of March 31 (p. 97 R) Mr. Brearley appears to argue that the value of specified composition and of analytical work for steel is overrated: and that properly trained chemists do not make mistakes; so, except for those "who are not sure of themselves," standards are of questionable value; and a man trained on a synthetic plan is not very respectful towards either statements or specimens issued under authority. The first two points are also treated in a recent paper read before the Institute of Metals by Col. F. N. Jenkins (this J., 1919, 123 R) who points out that chemical analysis as such is "of no interest to the engineer."

That wrong and exaggerated meanings have been attributed to small differences in composition is due to errors of *interpretation*, and these are no fault of the chemist. Exactly the same in turn occurs in respect to each new metallographic method and test devised of late years. Besides, the effects of composition on properties of material can only apply when it is in the same condition.

The intense desire to explain a difference often leads to a wrong sense of proportion. The present writer has frequently emphasised this. For example in one paper (Diseases of Steel—"Journal of the Iron and Steel Institute," Vol. II, 1903, p. 233) "When some unsatisfactory result is obtained with steel the only step usually taken is to analyse it and perhaps make 'tensile tests,' and if these do not show the cause of the trouble it becomes a mystery. . . . But analysis fails to explain most of the trouble met with. . . ." Again, under the head of Chemical Disease (p. 251), he stated "The fact of being different to specification, etc., may be an incident and not affect the question, for it cannot be too clearly understood that the specification of a particular composition is only a means to an end, *i.e.*, a roundabout way of expressing that steel of a certain nature is required, which nature is in many cases associated with that composition. But the possession of a certain composition is by no means in itself a guarantee that the steel has the required nature . . . similar chemical composition does not always secure similar mechanical results. The reason is, of course, that composition is only one of several factors affecting the result, and others may completely outweigh its influence." Chemical clauses in specifications should be taken rather as an ideal to aim at than a condition to be invariably enforced to the letter.

Whether or not chemical specifications are too rigid and the effects of phosphorus and sulphur in steel, for instance, overrated, engineers do include definite chemical limits in their specifications; and both for scientific and industrial ends, we may take it that:—(1) Analysis is to-day a necessity. (2) But it must be accurate. Yet however excellent the method or the individual work, it does break down occasionally. (3) Commercial necessities demand (*a*), methods which present the least possible opportunity for failure, (*b*), a ready means for detection when failure occurs whether of method or of working.

Analytical agreement between duplicates of a sample of unknown composition does not prove that an analysis is accurate, as faulty conditions may have affected both; whilst the figures in a complete analysis may add up to one hundred through compensation of errors. But a similar sample of known composition (analytically standardised) run

through side by side is almost certain at once to reveal error, and is the only ready means of checking work, and yet leaving the individual free to follow his own methods.

This raises an issue which must be clearly kept in mind, *viz.*, first the claims of purely scientific work essential to progress—which ultimately becomes commercially beneficial—and secondly those of commercial needs which are directly of service to mankind. The arguments advanced for or against a given course often show a great confusion of ideas. The first demands for the chemist the right of continual investigation and variation of method, and is primarily educational; whilst the second requires that, whether or not the result he gives is absolutely right, one may rely on a uniform result for the same sample, no matter who tests it; and that therefore he must sink his personality, and either work the methods of his own selection to give this for a standardised sample, or use a standard method. Under cover of the first claim objection is taken to standardised methods, and the more rigid adherence to detail is prescribed—and still more in the case of methods where it is automatically fixed—the greater is the dislike to "having one's hands tied."

Apart from the benefits to industry, the educative and moral effect of the thorough study of detail necessary to evolve standardised processes must be of still greater value. A young chemist may get into the habit of sending out work without knowing or caring whether or not it is correct so long as it gets through; but both the enforced attention to precise details when given in standard methods, and having his work continually checked by standards. must lead to his improvement. This cannot prevent him from investigating questions for himself if he has the chance otherwise.

Such means are the more necessary because, however good the repute of a firm of analysts, the most experienced seniors rarely make the analyses personally. They only organise.

Objection to these means is comprehensible if the practice of each chemist invariably gave good results. Manufacturers know that differences between buyers' and sellers' chemists are frequent and serious, and whoever thinks otherwise cannot realise or will not admit their extent.

In Table 3 of the writer's paper (this J., 1919, 24 T) differences between the results obtained by metallurgical chemists of repute and many years' experience, working on identical homogeneous samples, are given—see "first results." In another example, an alloy steel, the results reported showed the following astounding differences :—

	Lowest %	Highest %
Carbon	0·48	0·60
Silicon	0·065	0·19
Sulphur	0·027	0·068
Manganese ...	0·45	0·59
Alloy metal ...	0·20	0·35

The first step to overcome error is to admit it, then measures can be taken to detect and prevent it. No one using chemical standards regularly is likely to remain long in ignorance as to whether his methods or working are accurate.

Young chemists should be encouraged to investigate for themselves the influence of impurities; but often these, if added as reagents, have not the same effect as when they occur in steel—hence the advantage of standards of commercial material similar to the samples tested. The authoritative nature of these should not be autocratic, but derived from their acceptance for the common good by men representing the classes concerned; and the testing of any chemist's work against that of such men should strengthen his "sense of confidence in his work, and of responsibility for its actual accuracy."

THE DISCOVERY OF PETROLEUM OIL IN DERBYSHIRE.

The discovery of oil at Hardstoft, in Derbyshire, has a special significance for chemists, inasmuch as applied chemistry played an important part in the decision which led to the drilling enterprise.

In the past the discovery of an oil well was a matter of speculative drilling; as is well known, one of the first oil wells was obtained as the result of drilling for water. As time progressed geologists achieved remarkable success in predicting favourable spots and localities upon which to drill for oil, and at the present time no large company undertakes the exploration of a prospective oil-field before consulting a geologist.

In England there were many indications that oil should exist, and Dr. A. C. Veatch, chief geologist to Lord Cowdray, after a thorough study of these occurrences, became convinced that his views should be tested out by the drill. He was aided in his research work by Mr. E. L. Ickes, an American geologist who had assisted Lord Cowdray in Mexico. In England leading scientific opinion held that petroleum oil as such was not to be discovered, and that if any oil existed at all it would be found to have been derived from coal—possibly by a process of distillation.

The weight of such opinion could not be lightly ignored, although it is due to Sir John Cadman and some others to say that they entertained more optimistic views. Further evidence in support of the belief in the occurrence of petroleum was made available by the investigations undertaken by Mr. J. E. Hackford, chemist to Messrs. S. Pearson and Son, who advised that such seepages as had been found were the products of petroleum oil, and that, were wells drilled, any oil that would be found in them would be free petroleum, and would have no relationship whatever to those oils that might have been derived from coal beds by distillation or other processes. In December, 1915, he predicted that the oil when found would have the following characteristics :—Motor spirit, 5—10% ; kerosene (lamp oil), 40—50% ; gas oil (basis of fuel oils), 15% ; lubricating oils, 14—32% ; paraffin wax, 5% ; sulphur, 0·3—0·5% ; sp. gr., 0·860—0·890; setting point, below 0° F. ; viscosity (at 100° F. Redwood), 55 secs. ; chemical characteristics : paraffin base containing naphthenes.

The first well was spudded in at Hardstoft on October 15, 1918, and on May 27, 1919, oil was struck at a depth of 3077 ft. The analysis made by Mr. Hackford of a sample taken from it gave :—

Motor spirit 7½%.
Kerosene 39%.
Gas oil 20%.
Lubricating oils 30·5%.
Paraffin wax 3%.
Sulphur 0·26%.
Specific gravity 0·823.
Setting point 0° F.
Viscosity (at 100° F. Redwood) 48 secs.
Chemical characteristics : paraffin base containing naphthenes.

The good agreement between these results and the predicted figures is noteworthy, and opens up the prospect of the utilisation of chemistry in the work of oil exploration.

It is understood that the analysis made by Sir Boverton Redwood—his last official act as Director of Technical Investigations, H.M. Petroleum Executive—is in substantial agreement with the above figures, and that he was of the opinion that the oil was a true petroleum of excellent quality.

The oil is rising in the borehole at the rate of about 350 ft. per day, and there is evidence of gas pressure behind the oil.

NEWS FROM THE SECTIONS.

CANADIAN PACIFIC.

Mr. Noble W. Pirrie, recently Director of Explosives to the Imperial Munitions Board, gave an address on April 5, at the Board of Trade Rooms in Vancouver, on "Canadian Chemical War Industries," in which he described the very great contributions made by Canadian chemists and Canadian chemical industries towards the supply of vital war munitions.

Of the three new processes for manufacturing acetone developed during the war, namely, from acetylene, starch and kelp, the two former were the most successful and were worked out by Canadian chemists on an industrial scale. At Shawinigan Falls, Quebec, the acetylene process has been established as a permanent industry for the manufacture of acetic acid as well as for acetone. The acetone fermentation of starch was established industrially at the Toronto plant of the Godderham and Worts Distillery Co., this plant being given rent free by the company to the Munitions Board. A second plant was subsequently established at Terre Haute, Indiana, in the United States. The problem of disposing of the butyl alcohol obtained in large proportion as a by-product of the acetone-starch process was successfully solved by converting it into methylethylketone, just before the armistice was signed. Statistics were quoted showing the large proportion of high explosives supplied by Canada for war purposes as compared with the total Allied production.

The sympathy and condolence of the members of the Section was extended to the family of the late Thomas H. Young who died recently at Glendora, Cal. Mr. Young was a native of Birmingham, England, and on coming to Canada acted as chief chemist to the Canadian Pacific Railway at Winnipeg, Man. During the war, he was engaged at the James Island, B.C. works of the Canadian Explosives Limited, as inspector of trinitrotoluol production.

A paper on "The Fermentation of Kelp" was read on April 29, by Mr. C. J. Berkeley, recently research chemist to the Hercules Powder Works at San Diego, California.

The industrial production of acetone by the fermentation of kelp was one of the new chemical processes resulting from the war. It was developed in a very large way by the Hercules Company, some fifteen hundred tons of kelp being treated per day. Owing to the cost of harvesting the kelp, namely about one dollar per ton of wet material, and the yield of acetone from the wet material being only about one half per cent., the industry has been discontinued, now that the abnormal demand for acetone has ceased.

Mr. Berkeley described the development of the process and the procedure eventually adopted at the plant. Many months of close research work by a number of chemists were needed before the process reached its final shape. In addition to acetone, a very large variety of by-products, including potash, iodine, acetic acid and anhydride, and a series of esters and ketones, was turned out. The processes for producing and purifying these substances had to be developed independently. At the time the process was discontinued, a complete knowledge had not yet been obtained of the chemistry and bacteriology underlying the fermentation process, which was fundamental to all the other operations involved. Considerable information, however, had been accumulated on the complex questions presented. The prospect of basing a permanent industry on the fermentation of kelp does not appear promising. The use of the crude material as a fertiliser will probably continue but will be conditioned by the price of potash from other sources. It is greatly to be desired that further study should be pursued of the points involved in the fermentation because of their bearing on other points of industrial interest. The fact that pentosans make up a large proportion of the kelp plant and that these may be converted into useful products by fermentation, suggests the possibility of utilisation of the process in treating residues from yeast fermentations as well as direct fermentation of waste straw and similar vegetable material.

Following Mr. Berkeley's paper, the subject of German patents registered in Canada was discussed and action was taken to co-operate with other sections of Canada in obtaining legislation for the future protection of Canadian industries.

CANADA.

The Canadian Section of the Society of Chemical Industry held its annual meeting in conjunction with the second Convention of Canadian Chemists at Montreal on May 16 and 17. There are now in Canada the following groups of chemists:—The Canadian Section of the Society of Chemical Industry, the Canadian Pacific Section of the Society of Chemical Industry, the Manitoba Chemical Society, the Maritime Chemical Association of Nova Scotia, and the new organisation, the Canadian Institute of Chemistry.

It had been felt for some time that a purely Canadian institute for chemists was desirable, inasmuch as the qualifications for membership in the Society of Chemical Industry, in accordance with the terms of its charter, do not carry any professional status. With the Institute of Chemistry of Great Britain and Ireland as a model, the Chemists' Organisation Committee drafted a basis of procedure and qualifications for membership in the new Canadian Institute (see this J., 1919, 164 R). After full discussion of these proposals a representative group of original members was selected to form the nucleus of the new Institute. Representation by provinces was chosen, inasmuch as all charters of this kind must be obtained from provincial governments in Canada. Some twenty-eight prominent and representative chemists were selected to carry on the work, and to invite all eligible chemists in the Dominion to become either Fellows or Associates.

The new Canadian Institute of Chemistry is really a development of the Society of Chemical Industry in Canada, and should do much to unite all chemical organisations in the country under this Society. It is expected that during the coming year complete association of all industrial chemical societies will take place. The past year has shown remarkable growth in the Canadian Sections of the Society of Chemical Industry. The Toronto Branch is the strongest numerically, and has its membership fully organised. Every section and branch, however, has shown great strength and the Society is beginning to take the position it should hold, not only among chemists, but also in the eyes of the public generally.

Papers were given dealing with the war efforts of Canada along several lines. Mr. J. R. Donald gave a paper on the inspection of explosives and chemicals. Capt. E. T. Sterne and Prof. J. W. Bain presented papers on the war efforts of chemists in explosives and the work of the Canadian War Mission. Messrs. Speakman and Newman described the manufacture of acetone and methylethylketone by fermentation processes, which was carried on in a very large way in Toronto plants during the war. Mr. A. F. Cadenhead described the development of processes for preparing acetone from calcium carbide at Shawinigan

Falls, Quebec. This was, perhaps, the outstanding achievement of Canadian chemical research workers during the war, and the United Shawinigan Chemical Industries is now in a position to go forward very rapidly on a peace basis with the production of a number of new products depending on cheap electric power. Mr. J. A. Dawson, chairman of the Canadian Pacific Section, described recent developments in British Columbia, and expressed the hope that complete amalgamation of the societies' interests would follow shortly in Canada.

It was decided to hold the annual meeting of the Canadian Section at Toronto next year.

BIRMINGHAM.

At a meeting held on May 10, Dr. H. W. Brownsdon made a short communication relating to a recent application of colloidal platinum to the preparation of high resistances. By the process described it is possible to produce resistances of approximately 100,000 ohms carrying 5 to 10 milliampères on a piece of glass about $3 \times 2\frac{1}{4}$ in. The process has been perfected by Lieut. Catterson-Smith at the City and Guilds Technical College, Finsbury, E.C. The colloidal platinum (produced by arcing under water) is mixed with essential oils, and after the glass plate has been coated with the mixture it is stoved at a suitable temperature, and a fine continuous line of colloidal platinum is produced by removing some of the metal by combing in opposite directions. In a similar manner the mixture can be applied to glass tubes when the resistance takes the form of a spiral of colloidal platinum. Leads can be soldered to the resistances by means of a solder of low melting point.

LONDON.

The last meeting of the session, an informal one, was held at the Chemical Society's Rooms on June 2. An exhibit of rare metals and their salts was shown by Messrs. Johnson Matthey and Co., which excited considerable interest, as did also the displays of chemical apparatus, particularly English-made blown laboratory glassware, by Messrs. Baird and Tatlock and by Messrs. Townson and Mercer.

Messrs. George Kent and Co. showed instruments for measuring flow of gases in pipes. One apparatus of particular interest was a flow-meter for steam, the action of which depended upon the difference in pressure obtained on two sides of an orifice. This difference of pressure was registered on a moving paper by a style, the movements of which were corrected for different pressures of steam, so that it gave a graph which recorded the actual flow of steam past the orifice at any given time, without further correction.

Among the exhibits of Messrs. Baird and Tatlock was the K.P. clip, designed by Dr. C. A. Keane and Mr. G. Patchin, to secure a satisfactory means of preventing rubber connexions from slipping off glass and metal tubing, thus replacing the use of wire for this purpose.

Perhaps the most striking exhibit was that of the Zirconium Syndicate, Ltd., which showed a number of products made from zirconia. These included white oxide, oxychloride, soluble sulphate and soluble nitrate, as well as crucibles of various sizes and shapes, special articles manufactured to pattern, bricks, furnace-linings, and zirconia-lined graphite crucibles. It is understood that white zirconium oxide can now be produced on a commercial scale at a reasonable price, and the exhibits proved that zirconia can be readily moulded or worked into various shapes such as are likely to be required in industry.

MEETINGS OF OTHER SOCIETIES.

ROYAL SOCIETY OF EDINBURGH.

At a meeting held on May 5, with Dr. J. Horne in the chair, two papers of chemical interest were read. Prof. C. R. Marshall discussed the mode of action of metal sols. An attempt was made to determine the way in which metal sols act therapeutically by investigating the action of an electrolyte-free silver colloidal solution on bacteria. The action could not be explained by Brownian movement, surface phenomena, electric charge, catalytic power, or the concentration of ions in the dispersal medium. It appeared to be associated with the amicrons, which, it is suggested, are taken up by bacilli and probably converted into a soluble product.

In a paper entitled "An Analysis of an Electron Transference Hypothesis of Chemical Valency and Combination," Mr. J. Marshall discussed the Electron Transference Hypothesis put forward by Kelvin in 1902 and by Sir J. J. Thomson in 1904.

INSTITUTE OF METALS.

In the ninth Annual May Lecture delivered on May 19, 1919, Prof. Soddy covered much the same ground as in his lecture before the Chemical Society in December last (see this J., 1919, 38, 19 R). The more familiar phenomena characterising radioactivity were briefly reviewed. Incidentally, the lecturer mentioned that he did not regard potassium and rubidium as radioactive in the full sense. Comparing the penetrative power of γ rays and that of ordinary sunlight, it was remarked that γ rays would be stopped by an atmosphere equivalent to 25 cm. of mercury, whereas sunlight was easily able to penetrate the atmospheric equivalent of 76 cm. of mercury. Discussing the transmutation theory, Prof. Soddy remarked that in a sample of uranium sealed up in 1909, he had recently detected the presence of 25×10^{-11} grms. of radium, and he concludes that ionium, which is the immediate parent of radium, has a life period of 100,000 or 105,000 years, 1 part of uranium in 7,000,000,000 of uranium changing into ionium per annum. The theory of isotopes received its main support from the fact that the atomic weight of lead was found to be 206 when derived from uranium, 208 when derived from thorium, compared with 207·2 the atomic weight of ordinary lead. Further support is lent by the fact that the atomic weight of ionium —a metal identical with thorium in the general sense—is 230, compared with 232 for thorium.

The atomic model of Vegard—which embodies the results and views of J. J. Thomson, Rutherford, Bohr, Moseley, Debye, and others—contemplates a central nucleus surrounded by various miniature saturnine or planetary orbits in which revolve various electrons. The central nucleus carries a net positive charge represented by the atomic number of the element, and is responsible for the phenomena of mass and radioactivity. The succeeding closed orbits in order are responsible for the phenomena of *X*-rays, and the high frequency spectra of the element—the K, L and M series of lines. Chemical and physical changes affect only the outer variable unclosed orbit of valency electrons. Radioactive phenomena, originating in the very heart of the atomic system, have no temperature co-efficient, and hitherto have not been retarded or accelerated in any way. By atomic bombardment employing very much higher potentials than hitherto, the central nucleus might be affected and radioactive change accelerated. Only two ultimate disintegration products were known—lead and helium—but conceivably even these are not immutable.

INSTITUTION OF PETROLEUM TECHNOLOGISTS.

At a meeting on May 20 at the Royal Society of Arts, a paper by Dr. F. Mollwo Perkin and Mr. T. C. Palmer was read entitled "The Chemist and Engineer in Relation to the Petroleum Industry."

In the refining of oils the work of the chemist precedes that of the engineer, but it should not end when that of the engineer begins, for the happiest results are attained when both collaborate in designing the large-scale plant. A good example of successful collaboration by workers in the two professions is afforded by the shale-oil industry, but even here all the problems have not been solved—that of the elimination of sulphur, for example, still remains. It is probable that coal or other bituminous matter will prove to be most advantageously utilised when it is first carbonised at a low temperature and then burned in a producer, but for this procedure to be profitable the by-products must be utilised, for example the oils produced during carbonisation; these, however, contain unfortunately a large proportion of unsaturated hydrocarbons, of substances which tend to polymerise, and of phenolic substances. It is the task of the chemist to devise a satisfactory method of purification, and, since conditions easily attainable in the laboratory, such as high temperatures and pressures and the use of non-corrosive materials, are costly in large-scale working, the chemist and the engineer must consult each other both as regards any necessary modifications of the proposed process and in the design of a working plant. Essential features of the latter are:—Simplicity combined with the adoption of labour-saving devices, economy in heat and power, and efficient temperature control. Losses may be minimised by the use of automatic recorders of various kinds, by watching for leakages of steam and water, by careful attention to boiler-efficiency and by maintaining the fires evenly, the fuel (bought on its calorific value) being weighed or measured. The employment of superheaters and regenerative devices brings about great economies.

The extraction of gasoline from natural gases by compression, refrigeration and absorption illustrates the successful technical application by the engineer of physical principles.

SOCIETY OF GLASS TECHNOLOGY.

The May meeting was held at the Institute of Chemistry, London, on the 21st ult., Dr. M. W. Travers presiding. A lecture on "Some Phenomena of Pot Attack," delivered by Dr. W. Rosenhain, described work which he had carried out in collaboration with Messrs. E. H. Coad-Pryor, V. Stott and Miss A. B. Taylor. The first step in their investigation of improved methods for producing optical glass was to search for a material to arrest the attack of molten glass and to attempt the discovery of a container entirely insoluble in glass at high temperatures. The study of glass attack on clay was performed under novel and standardised conditions, *e.g.*, an electric furnace was used, so constructed that temperature and atmosphere could be kept constant. It was found in many cases that the attack was proportional to the depth of the clay beneath the glass surface. The bottom of the pot, which was most attacked, became drilled with holes of a roughly circular shape, owing, probably, to currents being set up in the liquid due to density changes. It was proved conclusively that holes could be drilled in a pot which was free from all defects to start with. The methods used in the research included the microscopic investigation of the glass and pot attack, and the application of *X*-rays to the examination of small pots.

THE CERAMIC SOCIETY.

The Spring Meeting of the Refractory Materials Section was held at Middlesbrough on May 22 and 23, Sir W. J. Jones (Deputy Controller of Iron and Steel Production, Ministry of Munitions) presiding over a large gathering of members. The Mayor of Middlesbrough, Sir Hugh Bell, Bart., and Mr. J. H. Amos—the two latter on behalf of the Tees Conservancy Commissioners—offered a hearty welcome to the visitors.

Prof. P. G. H. Boswell contributed a paper on "Mica Schist for Lining Cupolas and Steel Converters," in which he suggested the desirability of testing for the purpose Scottish and other material of similar character to that which has been used successfully in America. Dr. A. Scott mentioned that similar material was used in Sweden as early as 1740, and has also been used in several other countries.

In the paper on "The Corrosion of Coke Oven Walls, I.: The Salts Extracted from Coal by Washing," Mr. W. J. Rees stated that washing removed sodium sulphate as well as sodium chloride. By interaction with the hot coal, sodium carbonate would be formed from the sulphate and would have a strong corrosive action. Dr. J. W. Mellor suggested the possibility that the addition of one or more substances to the washing water might be more effective for washing the coal.

In "Some Criticisms by a Firebrick Manufacturer," Mr. G. R. L. Chance complained of the indifference of users in regard to the exact specification of their requirements, and to the general question of the quality of the finished product. The practice of ordering special firebricks with an inadequate time limit for delivery was also condemned. Another ground of complaint was the lack of facilities for fairly testing goods under service conditions. The great need for systematic testing of kilns for burning refractories, with a view to determining which are the best types, was alluded to.

Dr. A. Scott's paper, "Factors Influencing the Properties of Silica Bricks (Part I.)," dealt with the effects of various bonding materials (simple oxides and mixtures of them, with also carbon in a few instances where ferric oxide was used) on the properties of silica bricks, including specific gravities, porosity, after-expansion, and refractoriness, and also on the conversion of quartz into tridymite or cristobalite.

Dr. J. E. Stead's "Note on a Silica Brick from the Roof of an Open-Hearth Furnace" had references to the changes taking place during service. His results confirm those previously published by E. Rengade and C. S. Graham.

The paper by Dr. W. Rosenhain and Mr. E. A. Coad-Pryor on "A New Type of Recuperative Furnace" described a furnace, designed for use at high temperatures, which can be left for considerable periods (over night, for instance) without risk of serious deviation from the condition in which it is left by the operator. Mr. H. M. Ridge stated that a very similar furnace had been in use for some time.

"Specifications for Refractories for Glassworks' Use," communicated by Mr. W. J. Rees on behalf of a committee appointed by the Society of Glass Technology, relates to provisional specifications for tank blocks, raw clays, and grog. In recommendations and suggestions appended, the clays for pots are classed in three grades, of which grade 3 is the material in general use, and grades 2 and 1 are purer and more refractory. In each grade, the mechanical division and fusion test is prescribed for bind clay, base clay, and grog respectively, and the temperature of firing for grog. Two special points were raised in the discussion: firstly, as to cases where the same clay serves as both bind clay

and base clay, and secondly, as to grade 1 requirements, which were considered so severe that Dr. W. R. Ormandy said he doubted whether any material available would meet the stipulations.

The report of the Committee on "The Standardisation of Tests for Refractory Materials (Part III.)" was explained by Mr. Cosmo Johns. Three ways of conveniently examining the penetrative action of slags on fireclays and firebricks are described and illustrated. Mr. Johns added as a personal suggestion that it would be advisable to make use of slag of definite composition, prepared from pure materials, and not ordinary commercial slags or materials.

The report of the Committee on the British Refractories Research Association having been adopted by the Ceramic Society, the Association can be registered and start working. Members will consist of firms and companies, and also individuals, in any way interested in refractory materials and products. The affairs of the Association will be managed by a Council elected annually by the members, every branch of the industry and every locality concerned being represented on the Council as far as practicable. Dr. J. W. Mellor is to be technical director of the research work, and Mr. R. C. Rann has been appointed secretary. Members are to subscribe 5 to 50 guineas per annum for five years, and the only other liability is a guarantee of not more than five pounds per member in case of winding up during the period of membership or within one year afterwards. The scientific and industrial research department will contribute for five years a sum equal to that contributed by the members. It is intended to co-operate closely with similar research associations in other industries. Members will be entitled to the answering of technical questions, to the recommending of subjects of research, and to the use on favourable terms of any patents or secret processes resulting from the Association's research work. Subscriptions amounting to over 500 guineas per annum for five years have been promised already from a few members towards an estimated requirement of £3000 per annum.

A preliminary but comprehensive programme of research work has been formulated, and it is proposed to have refractories made to the Association's specifications, and to have such refractories tested under service conditions.

Sir William J. Jones was elected President of the Ceramic Society, and Messrs. W. Hamilton, D. Sillars, J. Whiteley, and Dr. A. McCance were added to the list of Vice-Presidents. New members of the Council elected were Messrs. G. V. Evers, Cosmo Johns, and Cyrus Jones.

It was announced that the Autumn Meeting would be held at Stoke-on-Trent, the Spring Meeting of 1920 in London, and the Autumn Meeting of 1920 in the United States, in conjunction with the American Ceramic Society.

ROYAL SOCIETY OF ARTS.

A paper entitled "Science and Industry in Australia" was read by Lieut.-Col. Hon. Sir John McCall, Agent-General for Tasmania, on May 27.

After discussing the general climatic and agricultural features of Australia, the author stated that science had worked wonders in developing the country. This was especially marked in recent years in connexion with the refrigeration and cold storage of perishable products, such as butter, cheese, frozen meat, and fruit. Sugar cultivation in Queensland has prospered under Protection, and the country is now practically self-supporting in this respect. Little sugar beet is grown, but it would be an excellent thing for the soil; it is now on trial in Victoria.

The various mineral industries were then reviewed, and the records of some of the famous mines enumerated. Platinum is being profitably produced in New South Wales, and osmiridium in Tasmania. It is proposed to utilise the enormous deposits of brown coal which occur near Melbourne to produce electric power, and to exploit the oil shales in New South Wales and Tasmania, the former yielding 150 galls. of crude oil per ton. The gold industry has suffered from the fact that the price of this metal is fixed, whereas the prices of all other commodities, including labour, used in its production have increased. Manufactures have developed rapidly, and the Commonwealth Treasury has recently authorised the expenditure of £2,500,000 on extensions to steel works, manufacture of white lead, zinc, cement, etc. The possibilities of an export trade to China, India, etc., are great.

With regard to chemicals, an important scheme is receiving attention for the manufacture of caustic soda; sulphuric acid, superphosphates, and eucalyptus oil are produced in large quantities. Arrangements are being made to manufacture tinplate in sufficient amount—about one million boxes per annum—to meet the country's requirements. Arsenical "dips" are being successfully manufactured, and the production of carbide has been started in Tasmania at a factory which will produce 5000 tons yearly. Works are also being built in Tasmania for the manufacture of electrolytic lead sulphate. In Victoria plants have been erected for paper manufacture and for the electrolytic production of bleaching material for use in the paper mills.

In addition to ferro-alloys and many other engineering requisites, the manufacture of chemical apparatus has been stimulated by the war. It has been found that balances, weights, retort stands, crucible tongs, blowpipes, Bunsen burners, etc., can be made and sold more cheaply than when they were imported from Germany. The imminent utilisation of the water-power resources of Tasmania offers great prospects; already extensive works have been erected at Hobart to smelt zinc concentrates from Broken Hill. The possibilities attached to the scientific development of industry have been realised by the Commonwealth Government, which has established an Institute of Science and Industry, as well as a Bureau of Commerce and a Board of Trade.

At a meeting held on May 28, Mr. H. J. Powell read a paper on "Glass-Making Before and During the War."

Although glass-making is an old-established English industry—there are records of its continuous existence in London for 300 years—it was, before the war, in a state of decadence attributed by men of science to the ignorance and lack of initiative of the manufacturers, and by the manufacturers to the divorce of academic and industrial chemistry and to unfair trading conditions. All but two of the glass works were small, and, although only scantily equipped for research, each had to work out its own problems. There was no institution from which scientific help could be obtained. The effect of free trade was disastrous. Foreign glass produced under conditions widely different from those in England was sold at prices below, or only slightly above, the cost of production here.

English manufacturers were driven from one expedient to another to keep their works alive. Thus one manufacturer whose staple was originally flint-glass table-ware and flint-glass tube turned to making glass for table-ware, lampshades, etc., then to processes of surface-decoration, and then to coloured glass for painted windows and enamels. Messrs. Chance fortunately kept alive, although

with difficulty, the manufacture of optical glass, their output of which has recently increased twenty-fold. English manufacturers were able on occasion to supply, for the purposes of special investigations, glass or glass apparatus which could not be obtained elsewhere.

English furnaces were constructed for making lead glasses which are not suitable for laboratory ware, although lead-potash glass is probably the most scientifically perfect glass extant. To meet requirements arising out of the war English manufacturers now to a large extent make lime-soda-alumina glass instead of lead glass, but their adapted and makeshift factories cannot be expected to compete on equal terms with those of Germany and Austria, which are fully organised and equipped for dealing with leadless glass.

Notwithstanding the shortage of materials (indicated by the enormous increase of prices) and of labour, special glass for the most varied purposes has been made during the war by British firms. Reports from a number of these indicate activity in the manufacture of optical glasses of all kinds, including coloured glasses and compositions containing the oxides of uranium, didymium or cerium, glass for thermometers, tubes for acid plants, laboratory ware, including vessels of zinc boro-silicate glass, and in the production on a very large scale of electric-light bulbs, tumblers, jars, etc.

While recognising the exacting labour of Sir Herbert Jackson's experiments and the patriotic intention of the Institute of Chemistry in publishing glass recipes, the author considers the acceptation of some of the formulæ as official standards as unfortunate. If they were regarded merely as helpful suggestions, the evolution of the best possible glass would be more likely to continue.

Glass blowing is an art which requires long training, and, notwithstanding the mechanical perfection of machine-made vessels, the passing of the handicraft cannot be regarded without regret. In designs for glass, attention should be paid to the nature of the material and more to form than to decoration.

INSTITUTION OF GAS ENGINEERS.

The fifty-sixth annual meeting was held in London on May 27, 28, and 29. In his inaugural address the President, Mr. Samuel Glover, remarked that the gas industry had supplied 21,800,000 gallons of benzol, 8,000,000 gallons of toluol, and 4,000,000 gallons of solvent naphtha to meet the country's needs in the prosecution of the war. The benzol represented 1,200,000 tons of picric acid, and the toluol about 65,300 tons of TNT. The efficiency of benzol extraction as practised by the industry varied from 0·3—0·8 gallon per ton of coal in South Wales to 2·0—3·0 gallons per ton of coal in Yorkshire. The President voiced a plea for efficient Government recognition of the industry as one of vital importance to the well-being of the country. In subsequent discussion, it was agreed to draw the attention of the Coal Controller and of the Board of Trade to the low stocks of coal at present carried by gas works—in general averaging 3 weeks' consumption in Greater London and 2½ weeks in outside areas—and to appeal against the suggested withdrawal of the Calorific Standards Order.

The report of the Gas Investigation Committee, which was presented to the meeting, is devoted principally to an examination of the utilisation of gas manufactured at the Uddington Gas Works, of calorific value 385—394 B.Th.U. gross per cubic foot, the make of gas being 30,000 cub. ft. of gas per ton of Lanarkshire coal. It appears from the report that in ordinary use, existing appliances for heating and lighting, designed primarily for the combustion of gas of a higher calorific value, can readily be adjusted for use with gas of a low calorific value by suitably enlarging the injector orifice, so that the effect of lower calorific value is counterbalanced by the increased hourly consumption of gas. Pressures lower than 20/10″ water column at the injector orifice secure efficient operation of the appliances, adjusted as above. A continuation of the work embodied in the first report (this J., 1918, 37, 681 A) on the efficiency in use of samples of gas of various calorific values confirmed the essential correctness of the proposal of the Fuel Research Board (this J., 1919, 191 R) to charge for gas on the heat units delivered in it, the appliances used for the combustion of the gas being suitably constructed and adjusted.

A discussion on the "Education of the Gas Engineer" was initiated by Prof. A. Smithells, who urged the prime importance of the accession to the ranks of the industry of men of high scientific attainment. The necessary scientific mastery was not to be achieved except by a continuous university education. He guardedly suggested that, on the whole, the desired end could be best achieved by a short period of works experience preceding such university course. The ensuing discussion revealed considerable diversity of opinion on this matter.

The report of the Refractory Materials Committee dealt with the "Crushing Strength of Firebricks" and "Heat Conductivity." The results included in the first part indicate that the crushing strength of a firebrick is diminished by reducing the grain size of the grog when the proportion of grog is constant, and also by increasing the proportion of grog when the grain size is constant. The crushing strength of a new brick is not necessarily at its maximum, but this appears to be influenced by the use and temperature to which the brick is afterwards subjected. The report on "Heat Conductivity" was devoted principally to a theoretical discussion of the effect of porosity of structure of the firebrick upon its heat insulating properties. A sample retort made by the slip process of casting was exhibited.

The report of the Life of Gas Meters Committee indicates that the dust deposits in gas mains do not originate in the oxide used for purification, but arise from corrosion of the mains by hydrocyanic acid in the presence of moisture. Spraying the mains by means of atomised paraffin oil is advocated as a remedy, otherwise precautions safeguarding against deposition of water in the main should be taken.

Dr. W. B. Davidson briefly reviewed the interrelation of the gas and dye industries. He pointed out that the consumption of gas per head of population is four times as great in Great Britain as in Germany. Reviewing the growth of the synthetic dye industry, he remarked that fifty years ago half a million acres in South Europe were devoted to the cultivation of the madder plant, the estimated value of the product being about £4,000,000. In 1913, over 3000 tons of alizarin and other anthracene dyes were imported into England. The distillation of coal with the recovery of by-products must be regarded as an indispensable industry, alike in peace and war. The main difficulty to be faced in the working up of by-products is concerned with plant. The various charges for the sulphuric acid contact process may be apportioned as follows:—Materials, 35%; amortisation, rents, rates, taxes, insurance, 45%; labour, 8%; repairs, 6%, and other charges 6%. He regarded the setting up of plants for the manufacture of intermediates as, in general, too risky a proposition for gas manufacturers. He did not anticipate any immediate improvement in tar prices through the demand for dyes, the value of the whole of the coal tar products employed by the German dye industry in any one year not exceeding £500,000.

Papers were submitted on the "Application of Reinforced Concrete to Purifier Construction" and "War Experiences of the British Gas Undertakings," the latter detailing the damage done to gas works by aerial and other attacks.

SOCIETY OF PUBLIC ANALYSTS.

Six papers were read at the meeting held on June 4, when Dr. S. Rideal presided.

In "The Examination of Commercial Samples of Nicotine," Mr. P. J. Fryer reviewed existing methods of estimating nicotine, and described the use of the refractive index as a means of determining the water content of nicotine solutions, whether the alkaloid be free or present as oxalate or sulphate. Mr. T. E. Wallis then gave an account of certain Mexican insects of the species *Notonecia* and *Corixa* used in certain poultry spices and foods, which form a regular article of commerce and have been sold under the name of "Mexican Cantharides." The descriptions given will enable analysts to identify the insects either whole or broken. The "Rapid Method for Determining Nickel and Cobalt in Ores and Alloys," Part III., described by Dr. W. R. Schoeller and Mr. A. R. Powell, consists in precipitating the metals by adding solid potassium iodide to a strongly ammoniacal tartrate solution. If present in small quantities, manganese is estimated colorimetrically in the precipitated cobalt, and if much be present it is eliminated by precipitating the nickel and cobalt as sulphides or xanthates.

Mr. E. R. Bolton's "Note on the Oil of *Ceratotheca sesamoides*" pointed out the great similarity between this plant and *Sesamum indicum.* With the exception of the Baudouin reaction, which is negative for the Ceratotheca oil, all the analytical results for the two oils were practically identical. The oil would be useful in edible products. With the aid of the "Improved Method for the Estimation of Nitrates in Water by means of the Phenolsulphonic Acid Reaction," of Mr. R. C. Frederick, nitrates associated with chlorides up to 100 parts chlorine per 100,000 c.c. can be very accurately estimated by using a special sulphonic-sulphuric acid mixture. The colour formed is compared with that produced by a standard ammonia solution. In the last paper, "Estimation of Morphine in Indian Opium," Messrs. J. N. Rakshit and F. J. D'Costa compared results obtained by the lime and polarimetric methods, and concluded that the latter offers certain advantages.

INSTITUTION OF MINING AND METALLURGY.

In his presidential address, delivered at the annual meeting on May 8, Mr. H. K. Pickard gave a valuable summary of recent developments in metallurgical practice.

Flotation methods have brought about greater progress than any other single invention, concentration practice having been revolutionised by their adoption. Progress in zinc metallurgy has been chiefly in matters of detail; the problem of mechanical roasting, especially of Broken Hill concentrates, still awaits solution; wet processes of extraction with subsequent electrolytic recovery have become firmly established.

In the metallurgy of copper, the use of reverberatory furnaces with increased throat-area has led to a largely increased output per furnace in America, where also leaching processes have come more into vogue. In this country, shortage of Spanish pyrites has led to the successful exploitation of pyrites in coal seams.

Crow's method of precipitating cyanide solution under reduced pressure has been the outstanding development in the metallurgy of gold.

NEWS AND NOTES.

NEW ZEALAND.

The Kauri Gum Industry.—A new factory for producing kauri oil is commencing operations at Redhill, Northern Wairoa. The company has 7500 tons of material ready for treatment, the yield is expected to be 75 galls. per ton, and an output of 100 barrels of kauri oil per week is anticipated. The crude oil yields the following fractions:—Motor spirit, 15%; solvent oil (used in rubber manufacture), 30%; paint oil, 30%; varnish oils, 30%; and the balance, pitch. The cost of production of the crude oil will not exceed 6*d.* per gallon f.o.b. (see also this J., 1918, 456 R).—(*Bd. of Trade J., May* 22, 1919.)

CANADA.

British Columbia.

Minerals, Metals, etc.—*Gold.*—A new strike of placer gold has been made on the Yukon River 45 miles above Marshall City, and a big rush has taken place towards the diggings.

The Forty Mile Power and Dredging Co., capitalised at $5,000,000, has acquired 96 miles of river claims and hydraulic benches near Dawson City, Yukon Territory.

Coal.—Many new foreshore locations for coal on Vancouver Island have been made east of the Comox area.

The Granby Consolidated Mining and Smelting Co. is building a 1000-ton washing plant at its new coal mine at Cassidy, Vancouver Island, at a cost of $150,000.

Iron.—The Hyatt Steel Products, Ltd., has taken over the Canadian Metals, Ltd., the Tudhope Electro-Metals, Ltd., and the rolling mills at Port Moody. Besides iron and steel, babbitt, solder and type metal will be manufactured.

The British Columbia Government has voted $50,000 to supply up to 10,000 tons of native magnetite ore for experimental purposes. The Tudhope Electro-Metals, Ltd., has applied for 5000 tons and the Vancouver Magnetite Iron and Steel Smelting Co., Ltd., for 5000 tons. The latter company proposes to instal auxiliary fuel oil burners in its blast furnace to obtain the temperature of 3000° F. necessary to flux the charge.

JAPAN.

The Salt Monopoly.—According to the *Japan Gazette,* the Salt Monopoly Administration has so far proved a failure. Since last summer complaints have been heard in all quarters as to a shortage in the supply of salt. The manufacture of salt by the monopoly authorities last year was reduced from about 607,000 to about 476,000 tons, and, as the consumption in Japan in recent years has been about 875,000 tons annually, there will be a deficit of 440,000 tons this year. Naturally the price is ruling high. The monopoly is said to have suffered a loss of over 400,000 yen (about £40,000) last year. The authorities are now trying to import salt from Tsingtau and China to make good the deficiency.—(*U.S. Com. Rep., April* 16, 1919.)

The Fertiliser Industry.—The small size of the average Japanese farm (2·64 acres) has rendered necessary such intensive cultivation that the consumption of fertilisers is, of necessity, extremely large. This has led to a large fertiliser industry, as may be seen from the total value of the production in 1916, *viz.*, over £6,000,000. Oilcake of various kinds is one of the most important fertilisers used, the annual yearly consumption, including imports of bean cake from Manchuria, being valued at over £7,000,000. Soya-bean cake meal is the standard oilcake of the Far East.

The use of chemical fertilisers, although of recent

growth, is increasing rapidly. The production in 1905 was valued at £370,000, and that in 1916 at £2,000,000. Superphosphate is manufactured in Tokio from phosphatic rock imported from the South Sea Islands. The local production of superphosphate is estimated at 500,000 tons and of sulphate of ammonia at 55,000 tons. Sulphate of ammonia is also produced, but the home supply is insufficient, 16,777 short tons being imported—chiefly from Great Britain—in 1917. Nitrate of soda is imported from Chile to the extent of 50,000—60,000 tons annually. Animal fertilisers are not used to any great extent; the most important is fish scrap obtained by drying and pressing herring, sardines, etc., valued at about £700,000 yearly. A peculiar fertiliser is made from dried silkworms and dried silkworm pupa. The total consumption of chemical fertilisers in Japan amounts to 600,000 tons yearly. It is stated that Japanese capitalists are planning to erect a plant with a capital of 20,000,000 yen (about £2,000,000) for the fixation of atmospheric nitrogen under certain American patents.

The above facts indicate that Japan is moving rapidly towards a position in which she will supply all the fertilisers she needs, so that the prospects of increased foreign trade are not very bright. Even sodium nitrate is now brought direct from Chile in Japanese steamers, the middlemen being entirely cut out. There should however be a field for sulphate of ammonia, animal fertilisers and special mixed fertilisers designed for specific purposes. There is no customs duty on fertilisers in Japan.—(*U.S. Com. Rep., April* 8, 1919.)

GENERAL.

The Salters' Institute of Industrial Chemistry.—Following the announcement of appointments already made (this J., 1919, 105 R), post-graduate fellowships have been awarded to the undermentioned chemists, who will continue their studies at the university or college indicated: Capt. W. H. Hoffert, B.A. (Oxford), Capt. A. G. Pollard, B.Sc., A.R.C.S. (Rothamsted Experimental Station), Mr. L. A. Ravald, M.Sc. (Municipal College of Technology, Manchester), and Mr. M. L. Wilson, M.Sc. (University of Manchester).

Endowments for Science at London Colleges.—Mr. Otto Beit, a member of the governing body of the Imperial College, has placed at its disposal the sum of £10,000 to be applied to building and equipping such departments of the college as may need most urgently assistance for development. An old student of the Royal School of Mines has contributed £8000 towards the equipment of an intermediate-scale laboratory for organic chemistry in the new building which is now under construction. The Goldsmiths' Company has offered the sum of £15,000 for the endowment of a chair of bacteriology at the London Hospital.

Industry and Higher Education.—A meeting of representatives of British universities and of the Federation of British Industries was held on May 20 to consider the establishment of some organisation for facilitating the transfer of university graduates to industrial life. Prof. Ferrier, of Bristol University, said there had been no difficulties in placing really first-class men, but men of the second class certainly needed assistance. There had been a marked tendency for university-trained men to proceed overseas, and even in the United States the English university man was generally sure of finding employment. Prof. H. B. Baker, of the Imperial College, agreed that the real difficulty was in fixing the second-grade student. In chemical industry there was routine work which would be more ably carried out by the trained man. The value of a well-trained man in routine work was not appreciated at present. A further meeting is to be held to deal with practical proposals for initiating a scheme.

Standardisation of Aircraft Materials and Parts.—With reference to our previous note on this subject (this J., 1919, 144 R), the British Engineering Standards Association has recently issued an index of specifications which are now, or will shortly be, available. The specifications number well over 200, and are classified under the following headings:—Bolts, brasses and bronzes, cast iron, dope and ingredients, electrical, fabric, heat treatments, engine parts, alloys, Technical Department Instructions (materials), petrol, steels, standard details, tubes, timber, wires, paints and varnishes. The specifications are on sale at 1½*d.* each, and a list of them is obtainable from the offices of the Association at 28, Victoria Street, S.W. 1.

The German Dye Industry.—A managing director of the dye works, formerly F. Bayer and Co., in Leverkusen, has recently stated that the dye industry had lost 60 per cent. of its former foreign trade. Nevertheless it is to be expected that this industry will play an important part in the future, especially in export trade. The fast light silk colours cannot be imitated, and no effort will be spared to recover the lost footing in foreign countries.—(*Deutsch. Allgem. Z., April* 18, 1919.)

Present Condition of the German Chemical Industry.—In common with most other industries, the German chemical industry is suffering much from the shortage of fuel. In the Frankfort district several works are making experiments with coal-tar oil as a fuel. The soap factories are receiving quite inadequate quantities of potash and calcined soda. The rubber factories in the Hanover district are short of the necessary fabrics, as well as of raw rubber. The chemical-pharmaceutical works are not receiving enough hydrochloric acid, soda lye, or soda, and the lack of glycerin and the embargo on the use of casein hinders the preparation of several important medicines. Only small quantities, at very enhanced prices, of indispensable raw materials, *e.g.*, varnishes and lacquers, are reaching the oil and colour works, while linseed oil, resins, copal and asphalt are confiscated. It is barely possible to obtain bright-coloured aniline dyes, since most of the works producing them are in the occupied zone. It is reported that the situation in the glass and porcelain industry is very serious. The Lahr Chamber of Commerce announces that the works there have been closed for months, and that the coal shortage is the sole obstacle to their reopening and giving employment to some 400 hands. The Dresden Chamber of Commerce sends a similar report with regard to the Saxon glass industry, which cannot possibly revive so long as the coal shortage continues. The Plauen porcelain industry has been at a complete standstill since November last. Similar reports are to hand concerning the Magdeburg glass industry, and from Altenburg, Rudolstadt, Sonneberg, Weimar and Hanover.—(*Deutsch. Allgem. Z., April* 24, 1919.)

The German Fine Chemical Industry.—As a consequence of Government decrees, alcohol is practically unavailable for technical purposes and some branches of the industry, *e.g.*, the manufacture of formic acid so important during the war, have been almost completely abandoned. The enormous price of some products is due to the lack of satisfactory raw material. Thus tannin must be made from the inferior and now highly priced German gall-nuts, since the Chinese and Japanese gall-nuts cannot be imported. Colour printers and others find gall-nuts too costly to use, prices in general having risen by 30 to 300 per cent.

Foreign countries have not yet succeeded in making the chemicals they require at costs even approaching those ruling now in Germany; and the export prospects for the German industry are therefore still to be regarded as favourable. For example benzoic acid costs in England 55—60s. a kilo. but in Germany only 18 marks. Potassium permanganate costs 60 mk. a kilo. in foreign countries as against 1.35 mk. in Germany. Many English firms therefore await the moment when they can resume former relations with the German industry, and this holds also for Russia and Poland. After the peace of Brest-Litovsk a brisk trade was established with the latter countries which was interrupted by the present disturbances. An extraordinary demand persisted however for silver nitrate, but not, as it appeared, for photographic purposes. The Poles offered more than twice the former price of 176 mk. with the object of preparing pure silver to augment their reserves, an intention which was soon discovered and frustrated.—(*Z. angew. Chem., April* 29, 1919.)

The Nitrogen Monopoly in Germany.—Speaking on the Nitrogen Monopoly Bill in the National Assembly, Herr Gotheim, a Minister of State, expressed doubt whether at the present time the price of nitrogen could be fixed relatively to the prices of agricultural products. The Government was itself greatly interested in a speedy supply of fertilisers to agriculture, but only 6000 tons of pure nitrogen was in stock. By the end of April 10,000 tons might be available, but transport difficulties might interfere with the distribution.—(*Z. angew. Chem., April* 25, 1919.)

German Potash Output.—On account of shortage of coal and transport, of strikes and reduced individual output, barely 120,000 metric tons of pure potash was produced in the first quarter of this year. This compares with 300,000 tons in the corresponding period of 1918. The value of the production has decreased from 77 to 35 million marks. Deliveries of potash in Saxony have increased considerably of late, six trainloads per week having been delivered instead of three.—(*Z. angew. Chem., April* 18, 1919.)

Socialisation of the German Potash Industry.—The Potash Syndicate, in a communication addressed to the President of the National Assembly, opposes the proposed scheme for socialising the potash industry. Before the war the potash trade was one-half as to quantity, and two-thirds as to value, an export one. In view of the severe competition already appearing from Alsace and that expected from Spain, and also because immediate decisions are necessary in the export trade, the projected Potash Council with 30 members is considered to be impracticable. Socialisation should be deferred until the conclusion of peace, and in any case should not extend to the export trade.—(*Z. angew. Chem., April* 29, 1919.)

Accumulators in Germany during the War.—The demand for accumulators in Germany was very great at the outbreak of war. The large types of submarines required batteries of 220 cells of 4500 amp.-hrs. capacity, weighing 80 tons and costing about 250,000 marks. In 1917, 86 submarines were launched, and in 1918 the monthly addition was from 10 to 14. The synthetic rubber produced by F. Bayer and Co. was of the greatest value in the manufacture of battery boxes. The output of this rubber reached 150 tons per month in 1918, at a price of 37 marks per kilo. For military purposes the transport of cells for charging necessitated the substitution of celluloid for glass to save weight. This material was at first defective, particularly in regard to cementing, but the quality improved later.—(*Elektrotech. Z., Feb.* 20, 1919.)

Sugar Production in Germany.—The following statistics, published by the Food Ministry, show the considerable decline in the production of sugar which took place in Germany during the war:—

Year	Cwts. of crude sugar
1913—14	52,358,700
1914—15	50,202,000
1916—17	31,158,600
1917—18	30,958,700
1918—19	25,000,000

The figure given for the current year is only an estimate; as, however, all raw sugar factories have already finished the working up of roots, there can be no important alteration in this figure. —(*Deutsche Allgem. Z.: Bd. of Trade J., May* 22, 1919.)

Peace Possibilities of the Swiss Chemical Industry.—In the *Schweizer. Chem.-Zeit.* (1919, 25—28; 65—69) Prof. E. Fierz discusses the present condition of chemical industries in Switzerland, and suggests directions in which developments might be made. In 1913 the value of chemicals exported from Switzerland was 67 million francs, and by 1917 this had risen to 175 million francs, whilst the corresponding values of the chemical imports were 85 and 157 million francs. The weight of exports, however, had fallen from 79,000 tons in 1913 to 74,000 tons in 1917, whilst the imports had fallen from 230,000 tons to 145,000 tons. Only in the branch of electro-chemistry was any improvement shown during this period, and this was mainly due to the demand for ferrosilicon, which increased by about 70 per cent., and for carbide, which, on account of its use as a substitute for manganese in steel, showed an increase of about 300 per cent.

Some compensation for the lack of iron and coal in Switzerland is to be found in the relatively abundant supply of water power, of which it is calculated that throughout the whole country on the average about 1000 cub. metres per second is available, with a fall of about 1000 metres. This would correspond to 13,400,000 horse-power, or, say, 10 million kilowatts. Assuming that 30 per cent. of this available power were utilised, it would be approximately equal to the available energy of Niagara, and would represent a saving in coal of about 4 million tons. It is estimated that utilisation of this source of electric energy would enable the following quantities of chemical products to be manufactured:—Nitric acid, 350,000; calcium carbide, 1,344,000; hydrocyanic acid, 273,000; acetic acid (from acetylene), 648,000; sodium hydroxide solution, 3,600,000; hydrochloric acid (30%), 12,000,000; and aluminium 220,000 metric tons. To these may also be added chlorates, perchlorates, bichromates, carborundum, calcium cyanamide, etc. The production of nitric acid, however, could not compete with its manufacture at Nottodden, where electric energy costs 10 fr. per h.p. per annum, as against 80 fr. in Switzerland.

Stress is laid upon the importance of utilising the whole of the coal imported by coking and distillation, and for this purpose it is suggested that communal coke and gas works should be established.

A factor of great importance for the future development of Swiss chemical industries is that they should be entirely in the hands of the Swiss; otherwise there is a risk of boycotting by other nations.

The financial support given in other countries to chemical enterprises should be imitated in Switzerland. With financial aid from the Swiss banks, chemical associations should be formed to study the conditions in foreign countries and to secure raw materials from countries such as the South American Republics. Diplomatic support would also be necessary in this direction.

The future of Swiss chemical industries appears to lie not in competing with the whole world in manufacturing products on a huge scale, but in developing a smaller industry of products of very high quality, as has been done, for example, in the watch industry.

Cement in 1917.—The United States attained a record production of Portland cement in 1917 of 92,814,202 barrels, valued at $125,670,430, or $1·354 per barrel, the highest price since 1899. The 1916 figure was $1·103 per barrel, and the output 91,521,198 barrels.

There were 117 plants working in 1917, an increase of 3 on the previous year, but there was a decrease of 18 kilns as a result of the substitution of several 40—90 ft. kilns by kilns 125—150 ft. in length; 636 of the kilns burned powdered coal, 103 burned crude oil, 6 burned natural gas and one producer gas. An interesting by-product of the industry was potash recovered mainly by means of the Cottrell process, 1806 short tons of potash as K_2O being obtained. The United States has now become practically independent of foreign supplies, the 1896 import figure of 3 million barrels having fallen to 2000 in 1916 and 1917.

Concrete barges have been in successful use on English canals since 1912, and at the time of writing 140 were under construction and also 24 concrete tug boats of various sizes. In France, China, Spain and Norway the construction of barges and small vessels of this material is proceeding apace. America, however, was the pioneer of large concrete merchant vessel construction, the ship "Faith," of 5000 tons dead weight capacity, equipped with engines of 3500 horse-power, being built at San Francisco. On a trial trip she developed a speed of over ten knots and successfully encountered a 60-mile-an-hour gale. One of the most serious factors in the construction is the adequate protection of the steel reinforcement from corrosion, such as by galvanising, and it is also recommended that some form of waterproof coating should be applied to the hull below the deck to prevent erosion. Another point of importance is that a concrete ship of 3500 tons dead weight capacity would weigh about 1300 tons more than a steel ship of the same capacity, and consequently would be more expensive to run. The construction cost per ton dead weight carrying capacity is estimated at $100—125, against $180—220 for steel ships. Experiments are being conducted to obtain a concrete of less weight by using light volcanic rocks.—(*U.S. Geol. Surv., Feb.*, 1919.)

Sodium Salts in 1917.—The basis of most of the sodium salt production in the United States is sodium chloride, but in 1917 four firms marketed sodium carbonate refined from natural deposits and two firms offered natural sodium sulphate. The production of sodium salts derived from natural sources was 7,108,835 short tons in 1917, valued at $24,445,676, as compared with 6,479,662 tons in 1916, valued at $16,600,406. Sodium compounds are steadily replacing potassium compounds, one important point being that they are economical from the freight point of view owing to the difference in the atomic weights of the metals. The production of soda ash in the United States has been:—1899, 390,653 short tons; 1904, 518,954 tons; 1909, 646,057 tons; 1914, 935,305 tons; 1916, 1,324,208 tons; and 1917, 1,578,889 tons.—(*U.S. Geol. Surv., Jan.*, 1919.)

Coal Resources of the Netherlands.—The following are the estimated coal resources of the Netherlands:—The Peel district, 1,766,000,000 tons; Southern Limburg, 3,165,903,537 tons; Winterswijk district, 324,000,000 tons; total, 5,255,903,537 tons, which, at the pre-war rate of 10,000,000 tons per annum, will last 525 years. The coal, however, is not first-grade. The price of Limburg coal last year was 17 florins (florin = about 1*s.* 7*d.*) per ton, whilst German coal was 90 florins, and is now 50 florins per ton.—(*U.S. Com. Rep., April* 18, 1919.)

China Clay in Bornholm (Denmark).—According to *Börsen*, new china clay deposits have been discovered at Bornholm. Preliminary examination shows the clay to be of first-class quality.—(*Weltwirtschaftszeitung, April* 18, 1919.)

Vanadium in Swedish Coal.—According to the *Aftonblad*, a concession has been given to work the coal beds in Ostergötland. The coal is of good quality, but its special characteristic is a content of vanadium. Analysis shows 0·95 per cent. of ash, of which 25 per cent. is vanadium. The cost of raising the coal is said to be 11·50 kronor per ton.—(*Metall. u. Erz, Mar.* 8, 1919.)

End of the Copper Scarcity in Norway.—The shortage of copper, from which all Norway, but especially the electrical industry, has suffered through war conditions, no longer exists. America is now in a position to deliver the whole of the metal purchased long ago on Norwegian account. In consequence of this, the electrical works at Christiania have forbidden the continued use of zinc and iron as electrical material. From July 1, 1919, only copper is to be used for electrical purposes. The imports from America will include large quantities of line wire.—(*Metall u. Erz, Mar.* 22, 1919.)

Mineral Resources of Holland.—The chief source of the mineral wealth of Holland is Limburg. Considerable coal deposits have been found at Kerkerade. In South Limburg there are not only coal mines but in the extreme south, near Epen, there are large quantities of good quality iron ore, zinc and lead, which have not yet been exploited. The discovery of clay and chalk in South Limburg has led to the erection of a Portland cement factory, which will be enlarged when transport facilities improve. Limburg limestone is much used for building, and Limburg clay, at present little utilised, is pure and of good quality. A very valuable sand for the manufacture of crystal glass is also found in Limburg. Both this province and North Brabant are rich in coal lying near the surface, and these mines, together with the coal fields at Winterswijk (Overijssel), would yield sufficient coal to furnish Holland's requirements for four centuries. There are excellent supplies of sand and iron ore in Brabant. Besides its coal fields, Overijssel yields rock salt, iron ore and some excellent quality clay. North and West Holland abound in peat. The sand dunes in the west, in addition to their value as a fertile soil for bulb culture, provide material for lime kilns, and the mud of the Ij valley is used in the manufacture of red cement.—(*Handelsblad, Mar.* 23, 1919.)

Wolfram Mining in Bolivia.—Bolivia is well known as a tin-producing country, but only within recent years has wolfram mining been added to its important industries. About ten years ago wolfram became an article of export, when it appeared in the list as "barilla," a concentrate averaging about 60 per cent. wolfram. Of this concentrate 186 tons, valued at £6255, was exported in 1908; the quantity steadily increased until in 1917 it amounted to 3828 tons, valued at £585,201, the United States taking far the greater part. Great Britain took 873 tons in 1916. The principal wolfram-producing district is La Paz, followed closely by Oruro, and at greater distances by Potosi and Cochabamba. The industry is now obtaining its produce from a large number of mines worked from the surface. A few derelict tin mines have been revived as wolfram producers. A large proportion of the wolfram industry in Bolivia is now under American control, British

interests being practically non-existent. German activity, which before the war was paramount, is now probably to a large extent disguised under Chilean colours.—(*Eng. Min. J., April* 5, 1919.)

The Economic Condition of Bulgaria.—Reports issued in November, 1918, by order of the Austro-Hungarian consular service contain valuable information relating to the economic condition of Bulgaria. The chief concern of the Government has been in connexion with ensuring increased output from the mines, and to this end large credits have been voted in the budget for the current year. The output of the government coal mines in Pernik for 1916 was 609,000 tons, an increase of 107 per cent. compared with 1914. The Plakanitza and Bor copper mines have been worked by Germany, and their output has been greatly increased. In the period 1902—1910 the total output of mineral ores in Bulgaria was as follows (in metric tons):—Copper 63,017, lead 9290, zinc 2397, zinc-lead ores 12,089, lead-copper ores 1034, and manganese ores 1930 tons.

The salt mines at Atana Riöj were conceded in 1906 to a Russian company. The annual outputs were (in metric tons):—4638·5 in 1911, 4265 in 1912, 4819·4 in 1913, and in 1914, 4800. The output of salt from Anchials was formerly about 9000 tons. The salt lakes of the Dedeagatch yielded in 1913 from 4000—5000 tons, in 1914 only 1500 tons of poor quality.

The total sugar production for 1916—17 was about 1000 waggons. The output of the Sofia sugar manufactory is normally about 1000 waggons. There was a general shortage of alcohol, beer and brewing materials, fats, soap and soda, surgical wadding and dressings. A syndicate of soap makers was founded in 1916 to take steps to remedy the shortage of fats and soda. The price of washing soap was fixed at 3, 2·20 and 150 lewa the kilo. according to quality (lewa=9½d.). In 1914 the paper imports from Austria-Hungary totalled 3,276,001 kilo., and from Germany 783,718 kilo. The demand for plate glass was much less than in normal times. There was an appreciable scarcity of hollow glass ware.

In the matter of chemicals, only the smallest fraction of requirements could be met by Germany under special conditions of export. The prices of sulphuric acid, caustic soda, tartar, naphthalene, disinfecting materials, etc., were very high. Supplies of caustic soda, ammonia, ferrous sulphate, naphthalene, and sodium bicarbonate were derived from Austria-Hungary. Owing to the shortage of petroleum there was a considerable import of carbide from Germany, Austria-Hungary, and Sweden, the price varying from 5 to 8 lewa per kilo. There was likewise a great shortage of medicinal supplies, and such necessary articles as quinine, aspirin, iodine, phenacetin and mercury were ultimately imported from Germany. Large quantities of indigo and washing blue were imported from Austria-Hungary, and aniline dyes were imported principally from Germany. Even should the chemical industry of Bulgaria be fostered by State assistance, it will not be in a position to cope with home demands. Hitherto supplies of ferrous and copper sulphate, naphthalene, paraffin, kerosene, sulphuric and tartaric acids, soda, phenol, sulphur, starch, glue etc. have been derived from Austria-Hungary. In the case of many articles, however, precedence was taken by England and France. After the war it can safely be assumed that the quota from Austria-Hungary can be considerably increased. The importation of artificial manures should be accompanied by propaganda, as the Bulgarian farmer is not enamoured of novelties. In drugs etc. the main supplies are derived from Germany. The French, however, are recognised as competitors not to be despised.—(*Z. angew. Chem., Feb.* 25, 1919.)

OBITUARY.

SIR BOVERTON REDWOOD, BART.

We regret to record the death of Sir Boverton Redwood, which took place suddenly, at the age of 73, on June 4 from heart failure after only two or three days' illness. Sir Boverton had just been engaged on the analyses of the oil from the Chesterfield boring in Derbyshire, an enterprise in which he had been keenly interested from its inception. Among his many activities in none had he been more keenly concerned than in the development of home supplies of oil, especially for fuel purposes. He had always kept an open mind on the possibilities of finding oil in this country, and speaking on this subject before the Institution of Petroleum Technologists in November 1917, he said "The nation would be blameworthy if it did not put that test (the drill) into effect." Sir Boverton was known to be a keen advocate of retorting processes for obtaining oil from cannel and other bituminous minerals, and considered that both the proposed borings and investigations of retorting should be carried on simultaneously.

His connexion with petroleum dated from its early days and he had for years been an expert of world-wide repute. He travelled widely and was personally acquainted with many of the important oil-fields. He was technical adviser on petroleum to most Government departments, to the Corporation of London, the Port of London Authority and other public bodies, and served on Lord Fisher's Royal Commission on Oil Fuel for the Navy (1912). He was also on the Home Office Committee on Acetylene Generators, was chairman of the Gas Traction Committee, and of the Committee on the use of Alcohol as Fuel.

Sir Boverton Redwood took an active interest in the Society of Chemical Industry, his first official connexion dating from 1884—92, when he served on the committee of the London Section, this being followed by two years as chairman. He served several periods on the Council, on three occasions was Vice-President, and filled the office of President in 1907—08, when he displayed great personal interest and activity in obtaining the Society's Charter.

Owing almost entirely to his initiative the Institution of Petroleum Technologists was founded in 1914 and he served as its first President, the new Institution rapidly developing under his support and guidance.

His activities during the war were many. On the formation of the Petroleum Supply Branch at the Ministry of Munitions he became Director of Petroleum Research. Later, when re-organisation took place, he became Director of Technical Investigations on the Petroleum Executive. He also served on several committees, including Trench Warfare, where his special knowledge was of great service in connexion with "liquid fire."

The unquestioned authority of Redwood throughout the world in matters relating to petroleum was ample testimony to his marked ability and wide knowledge. He was a man of keen insight, an able administrator and a clear expositor of any problem, however complex, with which he had to deal. Personally he was most kindly and took a great interest in many of the younger men who became associated with him, always lending his influence to further their interests and advancement.

The burial took place at Hampstead Cemetery on June 7. Among the many friends and relatives who attended the funeral were Dr. Charles Carpenter, Mr. W. F. Reid and Dr. C. A. Keane, representing the Society of Chemical Industry.

J. S. S. Brame.

PARLIAMENTARY NEWS.

HOUSE OF COMMONS.

Awards to Inventors.

Mr. Baldwin, Secretary to the Treasury, in reply to Sir C. Kinloch-Cooke, outlined the duties of the new Royal Commission (Powers and Functions) on Awards to Inventors. The main objects of the Commission are :—(1) To decide what awards are to be made to patentees for the use by Government Departments of their patents, where such awards are bestowable by statutory right under the Patents Act; and (2) to pronounce on awards which may be made as an act of grace. It will not devolve upon the Commission to determine the ownership of any invention, but to decide the validity of a claim to be rewarded by the Crown. Rival claimants to an award will be heard successively. The three main conditions which claimants, under the second heading, should fulfil are :—(*a*) Suggested inventions must have been reduced to a definite workable form. (*b*) The claimant must have been the first to communicate his invention to the Government Department. (*c*) The invention must be one of exceptional utility. —(May 22.)

Steel Imports.

Replying to Sir F. Hall, Sir A. Geddes (President of the Board of Trade) said that American steel manufacturers are quoting prices for delivery in the United Kingdom lower than those quoted by British manufacturers, though not to the extent suggested (£4 10*s*. per ton and upwards). The Government is not prepared at present to impose any restrictions upon the importation of iron and steel, in view of the demand in the country.—(May 26.)

Tinplate Industry.

Asked by Mr. Seddon as to the steps the Government intended to take to protect the tinplate and galvanised iron industries against American competition, in view of the fact that production costs are lower in the United States than in this country, Sir A. Geddes said that the tinplate industry in this country is finding a ready market for all its products, and, in view of the vital importance of encouraging our export trade, he would not at present take any steps which might restrict the available supply of such goods as are required for other industries.—(May 28.)

Government Laboratory.

Answering Mr. Hirst, Mr. Baldwin stated that temporary chemical assistants in the Government Laboratory are compelled to retire at the age of thirty. The regulation is included in the conditions of appointment and there is no intention of altering it.—(May 29.)

Sale of Linseed Oil to Germany.

Mr. Roberts, in reply to Sir R. Cooper, said that under the arrangements made at the Brussels Conference for Germany to be supplied with 70,000 tons of edible fats, a sale of 25,000 tons of linseed oil was arranged at £78 a ton. At that time there was a surplus stock of linseed oil in this country, which was previously offered to the trade at a lower price. The rise in price of linseed oil has been caused by neutral and enemy purchases in the countries of origin.—(May 30.)

Sulphate of Ammonia.

Replying to Sir A. Richardson, Sir A. Boscawen, Parliamentary Secretary to the Board of Agriculture, admitted that the control price at which sulphate of ammonia is being supplied to home agriculturists is below the cost of production. In answer to the complaint of the South Metropolitan Gas Company, that licences for export are obtainable only through the agency of a combination of trade competitors, the Board has replied that it cannot make exceptional arrangements.—(*June* 2.)

Coal Output.

In answer to Mr. Mackinder, Sir A. Geddes stated that the coal position is serious. Since the reduced working hours have been in force, the output has been at the rate of between 214 and 217 million tons per annum, compared with an output of 287 million tons in 1913. Exports will have to be reduced from the rate of 34 to that of 23 million tons, and except in the case of very small consumers, the rationing allowance now in force will be continued for another year as from July 1 next. After providing for the guaranteed profit to owners of 1*s*. 2*d*. per ton, the estimated deficiency in the working of the industry for the ensuing 12 months is valued at £46,600,000, equivalent to 4*s*. 3*d*. per ton of output. This means either an increase in price to the consumer of 4*s*. 6*d*. per ton, or the deficit will have to be met by the taxpayer.—(*June* 4.)

LEGAL INTELLIGENCE.

Exclusion of a Fellow from the Chartered Institute of Patent Agents. *Law* v. *Chartered Institute of Patent Agents.*

This case, which is reported in the issue of Reports of Patent Cases dated June 4, is of interest to professional institutions which occasionally sit in judgment, through their councils, on the actions of their members. It may be gathered from the case that in all such instances care should be taken that any member of the adjudicating council who may be regarded in any sense prejudiced against the member in question has no part in the adjudication.

It appears that the control of patent agents is vested in the Board of Trade. If, after due inquiry, the Board holds a registered patent agent to have been guilty of disgraceful professional conduct, the Board may order the Registrar to erase his name from the register. By the charter of the Chartered Institute of Patent Agents, any member of the Institute being held by the Council, on the complaint of any person aggrieved, to have been guilty of any act discreditable to a patent agent, shall be liable to exclusion from membership by resolution of the Council.

A complaint having been made that a patent agent who was a Fellow of the Institute had been guilty of misconduct, the Council of the Chartered Institute of Patent Agents referred the matter to the Board of Trade, postponing any action which it might think fit to take until the Board had decided whether an order should be made to erase the patent agent's name from the register. At the hearing before the Board of Trade, counsel appeared under instructions from the Council of the Chartered Institute to state the alleged misconduct and a member of Council gave evidence, the effect of which was against the patent agent.

Subsequently the Council of the Institute considered the alleged misconduct as affecting the desirability of retaining the patent agent as a Fellow of the Institute, and, having come to the conclusion that there was misconduct amounting to an act discreditable to a patent agent, passed a resolution excluding the Fellow from membership of the Institute. The Fellow brought an action in the High Court to restrain the Council from acting upon the said resolution, on the ground that the Council, so far as it was composed of members who had taken any active or substantial part in the proceedings before the Board of Trade, had no jurisdiction to adjudicate.

Mr. Justice Eve held in effect that the Fellow's contention was correct and granted the injunction sought.

PERSONALIA.

The honorary degree of Doctor of Science of the University of Durham has been conferred upon Sir E. Rutherford and Sir G. T. Beilby.

Sir J. J. Thomson has been appointed, by an Order in Council, to be a member of the Advisory Council for Scientific and Industrial Research.

The Albert Medal of the Royal Society of Arts for 1919 has been awarded to Sir Oliver Lodge, " in recognition of his work as the pioneer of wireless telegraphy."

The new Langworthy Professor of Physics in Manchester University is Mr. W. L. Bragg, now lecturer in natural science at Trinity College, Cambridge.

Prof. P. Phillips Bedson has been appointed President of Section B, Chemistry, at the forthcoming 87th annual meeting of the British Association at Bournemouth.

Sir Albert Stanley has resigned the office of President of the Board of Trade on account of ill-health, and Sir Auckland Geddes has been appointed to succeed him.

Dr. M. O. Forster has been appointed a member of the Senate of London University, and, by this Senate, a Governor of the Imperial College of Science and Technology.

The Medical Research Committee has appointed Mr. Harold King, of the Wellcome Chemical Research Laboratories, to the post of Organic Chemist in the Department of Biochemistry and Pharmacology.

Major A. J. Allmand has been appointed, as from September 1, to the University Chair of Chemistry at King's College, London. Dr. Allmand is an honours graduate of Liverpool University and an 1851 Exhibition Scholar; he has worked with Prof. Donnan at Liverpool, with Prof. Haber at Karlsruhe, as assistant lecturer in physical chemistry at Liverpool University, and recently as chemical adviser at Army Headquarters.

REPORT.

THE DEVELOPMENT OF WATER POWER.

SECOND REPORT OF THE WATER-POWER COMMITTEE OF THE CONJOINT BOARD OF SCIENTIFIC STUDIES.

The shortage of coal due to the war having rendered imperative a search for other available sources of energy, the development of hydro-electric power has received a world-wide impetus. It is estimated that at least 1,600,000 h.p. from water power will have been developed in France by the end of 1921 as compared with 750,000 before the war. In Italy concessions totalling over 250,000 h.p. is under development, and schemes are in hand for utilising up to two million h.p. in the near future. The National Economic Council in Russia is said to be establishing hydraulic stations to supply the whole of the power requirements of Petrograd; and in Scandinavia and Switzerland the already large installations are being still further increased. Attention is also being given to the question in Spain, Germany, and Austria. The electrification of railways is making progress, and in the United States one railway system alone, the Chicago, Milwaukee and St. Paul, will soon have about 860 miles of track electrified. In France much of the track in the region of the Pyrenees is already electrified, and further developments are pending in this and other countries.

The estimate of the water horse-power already developed in the United Kingdom given in the First Report of the Conjoint Board (this J., 1919, 320 R) has been found to be too low, and from the latest available statistics the figure for 1918 should be taken as approximately 210,000 h.p. In the majority of cases these powers are only utilised for a 10-hour day, and there is little doubt but that they could be made available for the full 24 hours at the same rate.

The Indian Government has arranged for official reports of the possibilities of sites in that country. Rain-gauge stations have been established and gauging observations on rivers have begun. In Ceylon little use has been made hitherto of the large powers available, while in the Federated Malay States the chief development has been in the direction of hydraulic mining. In British Guiana little official investigation of the very great possibilities has yet been made, but the recently proved extensive deposits of bauxite in the colony render it most probable that water-power will be developed on a large scale in the near future. In Canada matters are much more advanced, Government and Provincial departments dealing with water-power questions are in existence, as well as a Commission on Conservation. For the new developments at Niagara, turbines of 52,500 h.p. each at 305 ft. head and 187·5 r.p.m. are specified, and these will be by far the largest ever built. Proposals have been put forward for a joint scheme with the United States for the utilisation of the available power of the St. Lawrence river, which for a great part of its course forms the boundary between the two countries. A complete census of the hydro-electric developments throughout Canada has been published by the Dominion Water Power Branch of the Department of the Interior in co-operation with the Dominion Bureau of Statistics; this shows a total of 2,305,310 hydro-electric h.p. now developed. The increase in the last eight years works out at 126 per cent., and to-day Canada has 276 developed hydro-electric h.p. per 1000 of population against 100 for the United States. Of the total of 2,305,310 h.p. central electric stations account for 1,727,471, pulp and paper mills for 352,214, and other industrial establishments for the remaining 225,625.

In Australia little additional information is available, and in Tasmania the Government Hydro-Electric Department is continuing its policy of investigation. Nearly ten million h.p. from water power is estimated to be available in Papua (British New Guinea), and nearly as much more in the occupied territory of German New Guinea. This island appears to be in the enviable position of possessing for its size the most extensive water-power in the Southern Hemisphere. Increased interest in the development of water-power is being shown in New Zealand, but little fresh information is forthcoming from South Africa and Rhodesia.

The Committee concludes its report with a very strong recommendation that facilities for training in hydro-electric engineering should be at once provided at one or more of our universities, so that, in the future world development of hydraulic power, the British engineering enterprise may not be left behind.

OFFICIAL TRADE INTELLIGENCE.

(From the Board of Trade Journal for May 22, 29, and June 5.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 73, Basinghall Street, London, E.C. 2, from firms, agents or individuals who desire to represent U.K. manufacturers or exporters

of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

Locality of Firm or Agent	Materials	Reference Number
British India ..	Tanning materials ..	968
,, ..	Chemicals, drugs, dyes, paints	1020
,, ..	Dyes, yellow metal sheets, glass	1021
,, ..	Trinidad bitumen, cement, compositions for preserving wood and stone	1077
,, ..	Iron and steel sheets and bars, copper, brass and lead sheets and tubes, calcium carbide, paints	1078
Canada	Chemicals, dyes, medicines	*
Egypt	Coal, gas tar and pitch (tender for)	
,, ...	Paper	1024
New Zealand ..	Chemicals, fertilisers ..	1025
,, ..	Tinplate	1081
South Africa ..	Chemicals	1027A
,, ..	Tinplate, fertilisers ..	1032
Belgium ..	Dyes	974
,, ...	Laboratory apparatus ..	977
,, ...	China, porcelain, glass, earthenware, paper ..	979, 1041
,, ...	Brewers chemicals ..	981
,, ...	Oils, grease, colours ..	984, 1042
,, ...	Leather, skins	985
,, ...	Chemicals, colours, dyes, varnish	1043
,, ...	Tinplate, etc.	1046
,, ...	Pig iron, etc.	1050
,, ...	Oils, grease, inks, paint, varnish, china, glass, metals, chemicals, essential oils, dyes, fertilisers	‡2587 T & R
,, ...	Brass, bronze, gun metal	1082
France	Paper	988
,, ...	Animal fats, gums, bitumen	991
Italy	Metals of all kinds, asbestos, ebonite, celluloid	998, 1057
,, ...	Coconut oil, palm oil ..	1000
,, ...	Chemicals	1001
,, ...	Chemicals, dyes, coconut oil, leather	1056
,, ...	Copper sulphate, oils, fats	1059
,, ...	Chemicals, dyes, oils, artificial silk	1060
,, ...	Chemical and pharmaceutical products ..	1061
Netherlands ..	Colours, paints, varnish, oils, fats, wax, paraffin	1063
Portugal ..	Chemicals, metals, pharceutical products ..	1064
,, ...	Heavy chemicals, metals	1066
,, ...	Tar, inks, type metal, paper	1093
Russia	Machine oil, naphtha, petroleum, vaseline ..	§
Spain	Chemicals, drugs, perfumes, essences ..	1003
,, ...	Tinplate, cocoa	1004
,, ...	Chemicals, drugs ..	1006
,, ...	Dyes, chemical manures	1009
,, ...	Fertilisers, oil seeds, tinplate	1010
,, ...	Drugs, paints, varnish ..	1011
Switzerland ..	Pig iron, tinplate ..	1013
,, ..	Chemicals	1101, 1105, 1108
,, ..	Steel, copper, tin, zinc ..	1103
,, ..	Varnish, paint, chemicals	1107
Algeria	Oils, paint, varnish, glass, china, porcelain, leather, paper	1112
,,	Chemicals	1072
Morocco ..	Soap, candles, perfumes	1019
Palestine ..	Natural oils for perfumes	E 1/9‖
,, ...	Chemicals, drugs ..	J2 ‖
,, ...	Glass	J3 ‖
,, ...	China, porcelain ..	J4 ‖
United States ..	China, crockery ..	1117
Argentina ..	Chemicals, cement, paper	1118

* Canadian Government Trade Commissioner, 73, Basinghall Street, E.C. 2.
† Sir Aston Webb, Queen Anne's Chambers, Broadway, Westminster, S.W. 1.
‡ Belgian Section, Department of Overseas Trade, India House, Kingsway, W.C. 2.
§ Lettish Legation, 115, Park Road, Regent's Park, N.W. 1.
‖ Headquarters, Economic Section, O.E.T.A., Jerusalem.

TARIFF. CUSTOMS. EXCISE.

Australia.—The export of condensed milk is prohibited, save with the consent of the Minister of Trade and Customs, as from March 5.

The import of sheep dips is prohibited, save with the consent of the same Minister, as from March 26.

Brazil.—It is proposed to amend the customs duties on faience and porcelain.

Canada.—The form of the certificate which must accompany all importations of oleo-margarine is given in the *Bd. of Trade J.* of May 29.

Colombia.—The export of gold coin, bullion or dust is prohibited as from May 8.

An export duty of 5 per cent. *ad valorem* has been levied on platinum, to take effect on June 15.

France.—Mineral oils of British Indian origin are entitled provisionally, as from Jan. 18, to the application of the French Minimum Tariff rates of duty on importation into France.

Among the articles the import of which is now permitted, as from May 20, are oil seeds, gums, wood, oil-cake, paper pulp, marble, alabaster, lime, cement, graphite, copper sulphate and certain metals.

France and Algeria.—Raw skins and hides may be imported without licence, as from May 14.

Among the articles the export of which is provisionally prohibited are bones, hoofs, natural phosphates, bauxite, gold, platinum, iron ore.

Grenada.—The war tax on exported cocoa has been removed as from April 1.

Guatemala.—The new rates of customs duty on petroleum and gasoline, which come into force on July 1, are 5 centavos (gold) per kilogram in each case.

Italy (North Africa).—Cement, lime, coal, coke, heavy mineral oil and manures may be imported free of duty.

Madagascar.—The text of the Decree, dated April 20, regulating the import of poisonous substances, especially opium, morphine and cocaine, may be seen at the Department of Overseas Trade.

Netherlands.—Compressed fibre boards are subject to an import duty of 5 per cent. *ad valorem.*

New Zealand.—The import and export of tungsten, its alloys and compounds, are prohibited save with the consent of the Minister of Customs, as from March 18.

Among the articles which have recently been classified for customs duty are aeroplane varnish, magnesium chloride, certain soap compounds, Aladdin dye, and spirit of pennyroyal.

Panama.—The stamp duties on food pastes and soap have been abrogated.

Portugal.—The surtax on the export of paper is withdrawn as from May 10.

St. Vincent.—With some exceptions the revised rates of import duties are reduced to those imposed by the Customs Duties Ordinance, 1913, as from April 4.

United States.—A new General Import Licence "P.B.F. No. 37" covers the import from all countries, except Germany, Luxemburg, Hungary and Bolshevist Russia, of all commodities with a few exceptions which include pig tin, tin ores, concentrates and alloys, nitrates of potash and soda, salvarsan and all substitutes and equivalents thereof.

Manufactures of gold, the bullion value of which does not exceed 65 per cent. of the total value, may be exported without individual licences under the special licences applicable to commodities not on the Export Conservation List.

GOVERNMENT ORDERS AND NOTICES.

EXPORTS.

A general licence has been issued by the Board of Trade authorising the opening of credits on behalf of persons or bodies of persons in enemy countries.

Exports of Leather.—An open general licence has been issued for the export of rough and waxed splits and of all upper leather produced from hides and kips to all destinations, except those specified in connexion with goods on List C.

Germany.—The Board of Trade has issued a licence under which articles intended solely for the manufacture of human food may be exported to Germany.

Switzerland.—Licences for the export of foodstuffs on Lists A and B will be issued providing for consignment direct to the purchaser; foodstuffs on List C may now be sent direct to the purchaser without application to the Export Licence Department. Goods not consignable to the Société Suisse de Surveillance Economique (S.S.S.) need no longer be consigned to the British Legation at Berne.

Norway.—With the exception of goods on Lists A and B, all restrictions on export to Norway have been removed.

Czecho-Slovakia.—Goods despatched to Czecho-Slovakia should in future be consigned to the Commission Commerciale Tchecko-Slovaque at Hamburg.

IMPORTS.

The President of the Board of Trade, after considering the recommendations of the Consultative Council on Imports, has given the following further directions in regard to the prohibition of imports:

The restrictions on the importation of the following articles are removed:—

Fine balances; spring balances; celluloid in sheets, rolls and rods; aluminium sheets, foil, circles, rods, bars, ingots, angles, wire, tubes and strip; all hardware not otherwise specifically mentioned; peat moss litter; salt.

The importation of the following articles is to be licensed only exceptionally as and when required:—

Electric incandescent lamps (*i.e.* complete lamp bulbs with filaments), filament supports, contacts and tubes; manufactures of celluloid except sheets, rolls and rods; manufactures of aluminium except sheets, foil, etc. (*v.s.*); perfumery and toilet preparations.

The importation of the following articles is to be restricted as shown:—

The present ration for the following painters' colours and pigments (50 per cent. of 1916 imports) is to be maintained :—Brilliant, bronze blue, chrome green and yellow, chromate of lead, copper oxide, minium, oxide of tin, steel blue, Parisian blue, powder colours, red lead, vermilion. Bulbs for electric lamps are to be admitted at the rate of 50 per cent. of 1913 imports. Gas mantles, gas mantle rings and supports (earthenware) are to be admitted at the rate of 100 per cent. of 1916 imports in quarterly amounts. Carbons for arc lamps, cinemas and searchlights are to be admitted at the rate of 20 per cent. of 1916 imports.

A Consolidated List of Import Relaxations and Restrictions is given in the *Board of Trade Journal* of June 5.

NEW ORDERS.

"The Acids and Fertilisers (Suspension) Order. 1919," issued by the Minister of Munitions on May 30, suspends as from June 1, the operation of the following Orders :—Fertiliser Prices Order, 1918; Compound Fertiliser Order, 1918; Sulphuric Acid Order, 1917; Sulphuric Acid (Amendment of Prices) Order, 1918; Sulphuric Acid (Amendment of Prices) No. 2 Order, 1918.

The Mica Control (Suspension) Order, 1919. Ministry of Munitions, May 30.

The Food Controller has revoked Orders, issued in 1918 and 1919, dealing with the maximum prices for shredded suet, vegetarian butter and lard, oils and fats (compound), margarine, seeds, nuts and kernels, oils and fats.

COMPANY NEWS.

NEW PACCHA AND JAZPAMPA NITRATE.

At the annual meeting held on May 23, the chairman announced that the net output of nitrate during the past year was 535,000 quintals (quintal = 101·5 lb.), and the trading profit nearly £30,000, as against 527,100 quintals and £14,634 in 1917. No sales have been effected since the armistice was signed; but it is believed that all Government stocks in Europe have now been disposed of. High freights and the high cost of coal and stores will continue to handicap the position for a time, but there is little doubt that the inquiry in respect of next year's cultivation will cause a revival of demand. The general production in Chile is now reduced to a basis of little more than two-thirds of the 1917-18 output. The company's oficinas have, in common with many others, been shut down, but the raw material is still being won. The company has £54,000 locked up in nitrate and stores (capital £57,000 and debentures £6000). A dividend of 10 per cent. has been declared, £10,000 is placed to reserve, and £11,827 is carried forward.

SALAR DEL CARMEN NITRATE.

Speaking at the annual meeting on May 29, the chairman, Mr. H. W. Sillem, said that he did not anticipate the good results of 1918 being repeated in 1919. There is practically no shipping available for the carriage of nitrate, and, so far as British tonnage is concerned, licences to load nitrate are being refused, steamers in Chile being directed to leave in ballast to receive cargoes of foodstuffs and raw materials in other ports. In his opinion, Chilean nitrate has nothing to fear from the competition of the synthetic product. The cost of production of the latter is understood to be very high, and it does not possess the same fertilising properties as the natural article. The net earnings in the past year amounted to £70,680, or £18,128 more than in 1917. The dividend for the year is 20 per cent., £20,000 is set aside to reserve account, leaving £6995 to be carried forward. The production in 1918 was 789,930 quintals, as against 616,180 in 1917. In common with all nitrate producers, working costs were higher, but this item was more than offset by better market prices.

TARAPACA AND TOCOPILLA NITRATE.

Sir Robert Harvey, presiding at the annual meeting held on May 31, said that the directors had closed the oficina on January 1 last, and it is not intended to reopen it until the present large stocks on the coast have been disposed of; meanwhile raw nitrate is being extracted from the most difficult parts of the ground. No nitrate can now be sent from Chile to meet this season's needs. Excellent new ground has been located, and when it is worked the plan will be adopted of keeping men in the calicheras all the year round and manufacturing each alternate six months. Referring to the general situation, the chairman said that all nitrate has now to be sold through the Asociacion de Productores in Chile, the ordinary

grade at 10*s.* 1*d.*, and the refined at 10*s.* 4*d.* per quintal, f.o.b. Chile. The world's demand, exclusive of Germany and Austria, is computed at 2,000,000 tons, so that when these countries come into the market there should be no difficulty of disposing of a normal year's output, say, 3,000,000 tons. Stocks on the coast, on May 15, exceeded 28,000,000 quintals, compared with a normal quantity of 16—17,000,000.

The gross profit for 1917 was £81,675, compared with £75,470 in 1916; £40,000 is allocated to contingency account, and a dividend of 10 per cent. is declared, leaving £13,537 to be carried forward (capital £200,000).

SAN LORENZO NITRATE.

This company also shows improved results for the past year, the gross profit being £23,000 against £17,000 (capital £24,000), and the dividend is maintained at 25 per cent., tax free. The production is not given. Stores stand at £26,100, and there are large stocks of nitrate. The Company's oficina is being closed down.

New Registrations.—*British Dyestuffs Corporation, Ltd.*, has been registered with a capital of £6,000,000 to acquire all the assets of British Dyes, Ltd., and Levinstein, Ltd. The first directors include Dr. Herbert Levinstein, Sir Harry D. McGowan, of Explosives Trades, Ltd., Mr. G. P. Norton, Mr. J. Turner, and two others to be appointed by the Board of Trade. As previously announced, Lord Moulton is to be chairman.

Abram Lyle and Sons, Ltd., sugar refiners, etc., has been registered as a private company with a capital of £2,250,000.

TRADE NOTES.

BRITISH.

Jamaica in 1917.—The island was again visited by a hurricane in 1917, and the crops were materially affected. The imports were maintained at the usual level largely owing to increased prices. Whereas in 1907, Great Britain provided 47·4% of the imports as against 43·6% by the U.S.A., in 1917, Great Britain only provided 19·5% and the United States 70·1%. On the other hand, the United Kingdom now takes 44·8% of the island's exports as against 21·5% in 1907, while the share of the United States has fallen from 57·2% to 28·1%. The sugar production for the year has been a record one, the exports amounting to 32,000 tons, or double the amount of 40 years ago when sugar was the chief staple of the colony. Three new sugar factories have been provided for in St. Catherine and many projects for sugar developments are being actively considered by planters and capitalists. Considerable interest is now being taken in the growing of improved canes. The copra industry was extended during the year and drying plants are being erected in increasing number. Allowing for nuts converted into copra, the total exports were 30 million nuts and would have been greater but for the hurricane. Very good prices were obtained for hides, orange oil and honey, and pimento made a good recovery. The substantial sum of £540,000 was obtained for logwood and its extracts. The sisal plantation is progressing and the prospects are most encouraging. The work of the Deputy Island Chemist shows a decided increase, 1198 samples having been dealt with as against 988 in the previous year.—(*Col. Rep.—Ann.* No. 980, *Feb.*, 1919.)

Gambia in 1917.—The total value of the imports into this colony was greater by £218,247 than in 1916. The United Kingdom continued to be the chief source of supply, accounting for 58% of the imports as compared with 41% in 1914. Importations from France have dropped from 22% to 12% in the same period, and those from the British Colonies from 20% to 19%. The value of exports increased by £410,063. The principal articles were ground nuts, hides and palm kernels. The ground nut crop was above the average, 74,300 tons being shipped as against 46,366 tons in 1916. Of the total crop, 75% went to Great Britain. Owing to the great mortality among cattle the export of hides constituted a record at 101,120, valued at £58,951; of these, Great Britain imported 97·9%. The export of palm kernels decreased from 669 tons to 532 tons. Of the total exports, 79% went to the United Kingdom and 18% to France.—(*Col. Rep.—Ann. No.* 979, *Feb.*, 1919.)

FOREIGN.

The Japanese Dye Market.—It appears probable that licences will shortly be issued for the importation of dyestuffs into Japan. Home production does not seem to have been nearly sufficient to meet the demands; thus it is estimated that while pre-war imports of dyestuffs were valued at £900,000 per annum, the total paid-up capital in the Japanese dye manufacturing firms is £640,000. The Committee of the Diet has been asked to consider a scheme for establishing factories on a large scale from which materials could be distributed to smaller factories who could produce finished dyes. Although it appears doubtful if Japan can compete with Europe and America except under the protection of a tariff, the agitation for increased import duties has apparently not attained its object.—(*Bd. of Trade J., May* 22, 1919.)

Market for Chemicals and Drugs in Puerto Cabello (Venezuela).—There is little demand for industrial chemicals in Puerto Cabello, but drugs and medicines are constantly required. The imports in metric tons during 1916 and 1917 were, respectively: —Acetic acid 24·3, 16·9; sulphuric acid 21·0, 121·0; anhydrous ammonia 56·7, 39·7; carbon dioxide 111·1, 100·6; calcium carbide 979·4, 249·9; disinfectants 207·1, 151·3; drugs, medicines etc. 700·5, 1063·3; soda, caustic and ash 637·0, 767·8; soda silicate 237·9, 356·4; quinine 6·5, 9·6.

The soap and candle industry alone depends considerably on imports, but a certain amount of caustic soda is used in oil refining. Liquid ammonia is employed for refrigeration and liquid carbon dioxide for carbonated drinks; calcium carbide is purchased in diminishing quantities on account of electric light installation. Cotton dyes came originally from Germany, but now the United States controls the market. There are small imports of tanning materials, native woods being chiefly employed. The drug trade is important and the consumer pays heavily; imported and local proprietary medicines find a ready sale. Quinine, Epsom and Glauber's salts, bicarbonate of soda and disinfectants are largely sold.

Great Britain, France and Germany supplied most of the chemical imports before the war, but it is claimed that in 1916-1917 the United States supplied 73 per cent. Most of these imports are made through about six large drug houses.—(*U.S. Com. Rep., April* 12, 1919.)

Alcohol Production in Cuba.—Efforts are now being made to establish ten up-to-date plants for the manufacture of alcohol from molasses. About 40 gallons of molasses result from the production of a ton of sugar, and this quantity yields 16 gallons of good quality alcohol. The estimated sugar production in Cuba for this season is 4,000,000 tons. The following figures show the export of molasses during recent years (gallons):—1912, 55,765,635; 1913, 60,952,741; 1914, 84,652,997; 1915, 101,215,679; 1916, 128,598,459. The proportion of these exports

going to the United States has gradually increased until in 1916 it amounted to 90 per cent. Alcohol has been exported from Cuba in small quantities for several years past; the amount increased greatly in 1916 when over 2½ million gallons was exported.—(*U.S. Com. Rep., April* 15, 1919.)

The Varnish Market in Italy.—The time is very opportune for the introduction of varnishes into Italy, the market being very bare. The trade was formerly in German hands. The following quantities were imported during the first nine months of 1918 (kilograms):—Alcoholic varnishes, all from the U.S.A., 438; non-alcoholic varnishes containing mineral oils: Great Britain 12,348, France 3746, U.S.A. 936, Australia 198, and Sweden 100. All other varnishes: France 4027, Great Britain 64, U.S.A. 687.—(*U.S. Com. Rep., April* 30, 1919.)

Italian Perfume and Essential Oil Industry.—This industry has of late years been a source of profit, and it is now receiving Governmental encouragement, a decree having just been passed exempting the land and machinery used by these trades from a number of taxes and duties. In 1917 the output was 30,000 kilo. of mint essence, 2500 kilo. of essence of lavender (Piedmont and Liguria), 400 kilo. of thyme essence and 200 of myrtle (Sardinia). The value of the exports in 1913 amounted to nearly £500,000, the chief essences in order of value being lemon, bergamot, orange and mandarin.—(*Bd. of Trade J., April* 10, 1919.)

REVIEWS.

COLLOID CHEMISTRY.

FIRST REPORT ON COLLOID CHEMISTRY AND ITS INDUSTRIAL APPLICATIONS, 1917. *Pp.* 86. (*London: British Association for the Advancement of Science*, 1918.) *Price* 2*s. net.* SECOND REPORT ON COLLOID CHEMISTRY AND ITS GENERAL AND INDUSTRIAL APPLICATIONS, 1918. *Published for the British Association for the Advancement of Science by the Department of Scientific and Industrial Research. Pp.* 172. (*London: H.M. Stationery Office*, 1919.) *Price* 1*s.* 6*d. net.*

When Graham, more than fifty years ago, carried out his classical researches on diffusion and dialysis, and directed attention thereby to the existence of apparently homogeneous mixtures which differed in their behaviour from ordinary solutions, he laid the foundations of a new branch of physical and chemical science. Although, for a considerable time, the study of these apparently homogeneous mixtures or colloidal sols, as Graham called them, attracted comparatively little attention, their importance, both for physical theory and for industrial practice, has, in recent years, become increasingly recognised, and the special literature which has grown up around the subject of colloids has already attained a very considerable volume. And the volume is rapidly increasing owing to the growing number of investigators, both in pure and applied science, who have taken up the study of the many problems which colloidal matter offers for solution. So rapidly are the experimental results accumulating, so widespread and varied is the *rôle* which colloids play, that it is already becoming difficult to master all the facts and to bring the widely diverse fields of investigation into due co-ordination. The difficulty also is increased by the fact that the soil is still largely virgin, and that, owing to the lack of guidance by well-established theory, the digging and delving have been carried out in a somewhat haphazard manner. The appointment, therefore, in 1916, of a Committee of the British Association "with the object of compiling information regarding the advances which have been made in capillary and colloid chemistry with special reference to industrial processes," was a step of really great scientific importance; and the two reports which that Committee has already issued will undoubtedly receive the welcome which their excellence deserves.

The subjects dealt with in these two reports are arranged on the twofold basis of colloid properties (*e.g.*, viscosity, adsorption, peptonisation, etc.) and technical processes, and this method of classification has much to commend it. Any overlapping which is thereby involved is really an advantage, for it has the merit that it becomes possible not only to write a connected account of the advances made in the investigation of certain properties but the close interconnection between scientific principles and technical practice is rendered more evident. Incidentally, the necessity of greatly strengthening the purely scientific basis of many industrial processes becomes apparent.

In the first report, the viscosity of colloids is discussed by E. Hatschek in a brief manner, but a comprehensive bibliography of literature published during and after 1912 is appended. In subsequent sections of the report the following technical processes and applications generally are treated:—Tanning; dyeing; fermentation industries; rubber; starch, gums, albumin, gelatin, and gluten; cements; nitro-cellulose explosives; celluloid; physiological and biochemical subjects. Of these reports, those on "Colloid Chemistry and Tanning," by H. R. Procter, and on "General Review and Bibliography of Dyeing," by C. E. King, will arouse special interest. In the treatment of hides the well-known property of the gelatin-like colloids of swelling in dilute acids and of becoming dehydrated by salts is made use of in the process of "pickling," whereas in vegetable tannage the fixation of the tannin appears to be due to an electrical attraction between the positively charged hide and the negatively charged colloidal tannin.

The second report is a document of still greater interest and value than its forerunner. Here are given excellent short accounts of the present position of our knowledge regarding peptisation and precipitation; emulsions; the Liesegang phenomenon; electric endosmose (kataphoresis), both in its scientific and technical aspects; colloid chemistry in the textile industries; colloids in agriculture; sewage purification; dairy chemistry; colloid chemistry in physiology; and administration of colloids in disease. The list of subjects dealt with will give a sufficiently impressive idea of the penetration of colloid chemistry into numerous and widely diverse branches of science and technology. Without exception, all the reviews are well done, and one's confidence in their reliability is strengthened by the fact that the authors are all recognised authorities, each in the special department with which he deals. It is, perhaps, the writer's own interests that prompt him to select for special mention the report on Peptisation, by W. D. Bancroft, and Colloid Chemistry in Physiology by W. M. Bayliss. Both reports are excellent, and place the relevant facts in due order and perspective. Neither is a mere impersonal summary of work done or theories advanced, but freshness and vitality are imparted to each by the general personality and views of the writer. The excellent account by T. R. Briggs of Electrical Endosmose and its various industrial applications will be read with much interest by many, who will also not fail to note the author's somewhat restrained appreciation of the alleged merits of "electro-osmosis" for the de-watering of peat and clay. This section is especially valuable owing to the list of patents appended to the report. At a time when the textile industries are setting up Research Institutes the review of "Colloid Chemistry in the Textile Industries" by W. Harrison is very opportune. On reading this review one is impressed

chiefly by the large field of investigation which still remains to be cultivated.

The two reports of the Committee on Colloid Chemistry, and more especially the second, deserve to be read by all students and workers whether in pure or applied chemistry. Industrial practice, it must be confessed, is at present considerably in advance of our knowledge of the underlying principles, and it is therefore greatly to be desired, in the interests of a more rapid and economical industrial development, that the theoretical foundations of colloid chemistry should be strengthened. The reports before us, and those which will doubtless appear in the future, will do much to stimulate activity in this direction, and the Committee of the British Association responsible for their publication deserves the warm gratitude of all students and workers in the domain of colloid chemistry for the valuable service they have rendered to science.

ALEXANDER FINDLAY.

ALSATIAN POTASH.

LES MINES EN ALSACE-LORRAINE. L'INDUSTRIE DE LA POTASSE DE LA HAUTE-ALSACE. *Rapport par* M. FÉLIX BINDER. *Dec.* 1917. *Pp.* 94 *and* 3 *maps.* (*Paris: Ministère de la Guerre.*)

Although it is difficult to regard this report as other than pure propaganda, it is nevertheless propaganda in a good cause, and scientists and industrialists everywhere (outside Germany) will be grateful to the author for compiling so readable a statement of the case.

In the autumn of last year M. Paul Kestner read before the London Section of the Society of Chemical Industry a highly important paper, which rightly attracted much attention, upon the significance of the Alsatian potash-deposits in relation to the terms of peace (this J., 1918, 291 T). Since then it may be said that the German monopoly of potash has been for all time broken. Most of the information put forward by M. Kestner is included in M. Binder's report, and it is therefore unnecessary to do more than summarise it. M. Binder is thorough in his treatment of the potash question. He describes the history of the deposits in both Stassfurt and Alsace, and in assessing the resources and value of the latter, he emphasises their freedom from salts of magnesium. A brief account of the remaining world-supplies is given, and the remarks upon the Abyssinian deposits will interest those who have been puzzled by the contradictory reports of the peculiar resources there. He states (or quotes) the view that they have arisen from the evaporation of hot solutions, presumably of "juvenile" or deep-seated origin.

Reverting to the industrial aspects of the question, the author proceeds to recount the work of the Kali-Syndikat, the growth of the use of potash in agriculture and industry, both inside and outside Germany, and the control and allocation of sales. It is noteworthy that, of the 155 mines participating in the output before the war, the Alsatian mine Amélie I had 11·882 thousandths of the total production allocated to it—a proportion almost equal to that of the largest of the North German mines. This bears witness to the importance and quality of the Alsatian contribution to the potash supply. The "Kux" system (=mine shares of 3000 to 5000 marks) is described by the author, and reference is made to the "potash war" of 1909, as well as to the difficulties experienced in the attempt to hold a balance between taxing the potash and increasing its adoption in agriculture.

M. Binder gives full economic details of the Alsatian mines, both those under Franco-Alsatian control, which formed only a small proportion of the total, and those worked by German capital. Following a short account of their exploitation by the enemy, M. Binder proceeds to what may perhaps be considered the crux of the report, namely, their exploitation in the future under the *régime* of France (written, it should be remembered, in 1917). The water and other communications of Alsace with France, Switzerland, Italy and Spain are considered, and the hope expressed that the last three countries will become clients. More difficulty, on economic grounds, may be experienced in displacing German potash from other European countries, but the author hopes (and his hope will certainly be realised) that preference will be given in Britain to Alsatian potash. The importance of the North American ever-growing market is emphasised, and is followed by details of American consumption of potash, and of American exports to France and Germany. A plea then follows for the retention of Alsace by France and for the support of American capital to assist in developing the Alsatian deposits. The first part of the plea may now be regarded as a *fait accompli*. Is it too much to ask that not only American, but British capital may be invested in the restored provinces?

The report is accompanied by an appendix by M. Eccard upon the financial arrangements to be established for the Alsatian mines, by a short bibliography, and by three useful maps. It is clearly, simply and yet concisely written, and the author may be cordially congratulated upon the results of his labours.

P. G. H. BOSWELL.

PUBLICATIONS RECEIVED.

THE CHEMISTS' YEAR BOOK, 1918-19. *Edited by* F. W. ATACK, *assisted by* L. WHINYATES. *In* 2 *volumes. Pp.* 1146. (*Manchester: Sherratt and Hughes.* 1919.) *Price* 15*s.* 6*d., post free.*

CALCULATIONS USED IN CANE-SUGAR FACTORIES. *By* I. H. MORSE. *Second Edition, Rewritten. Pp.* 189. (*New York: John Wiley and Sons, Inc. London: Chapman and Hall, Ltd.* 1917.) *Price* 9*s.* 6*d.*

OUTLINES OF THEORETICAL CHEMISTRY. *By* F. H. GETMAN. *Second Edition. Pp.* 539. (*New York: John Wiley and Sons, Inc. London: Chapman and Hall, Ltd.* 1918.) *Price* 16*s.* 6*d.*

ORGANIC CHEMISTRY. *By* V. VON RICHTER. *Edited by* R. ANSCHÜTZ *and* G. SHROETER. *Vol. I. Chemistry of the Aliphatic Series. Second (Revised) Edition. Newly translated and revised from the German edition (after Prof. E. F. Smith's third American edition) by* P. E. SPIELMANN. *Pp.* 719. (*London: Kegan Paul, Trench, Trübner and Co., Ltd.* 1919.) *Price* 25*s.*

REPORT OF THE FOOD INVESTIGATION BOARD FOR THE YEAR 1918. *Pp.* 20. *Department of Scientific and Industrial Research.* (*London: H.M. Stationery Office.* 1919.) *Price* 3*d.*

THE LITERATURE OF REFRIGERATION. *A list of English, American, French, Italian, and German Books, Journals and Proceedings, compiled by the Food Investigation Board. Department of Scientific and Industrial Research.* (*London: H.M. Stationery Office.* 1919.) *Price* 4*d.*

ANNUAL REPORT OF THE UNITED STATES NATIONAL MUSEUM, 1918. *Pp.* 175. (*Washington: Government Printing Office.* 1919.)

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MINERAL WATERS IN 1917. *By* A. J. ELLIS.

IRON ORE, PIG IRON AND STEEL IN 1917. *By* E. F. BURCHARD.

FUEL BRIQUETTING IN 1918. *By* C. E. LESHER.

GOLD AND SILVER IN 1917. (*General Report.*) *By* H. D. MCCASKEY *and* J. P. DUNLOP.

CADMIUM IN 1918. *By* C. E. SIEBENTHAL.

PRODUCTION AND SUPPLY OF SUGAR WITHIN THE EMPIRE.

Early in 1917, a Committee was appointed by the London Section of the Society with the following terms of reference :—

"1. To prepare an account of the pre-war sugar position as regards (a) Production, its amount and nature; (b) Consumption, its amount and nature, and (c) The quantity, nature, and source of the sugar imported and exported, of each unit of the British Empire.
2. To ascertain the economic sugar producing possibilities of each unit of the British Empire.
3. To report on the most likely localities for increased supply, as well as on the kinds of sugar required by the various consumers throughout the British Empire.
4. To make such technical suggestions as may appear of use to the development of the industry."

The Committee, the formation of which subsequently received the assent of the Council, consists of members of the Society, and certain co-opted experts in different branches of technology, that is to say, those interested in the production and refining of sugar, as well as other trades employing sugar such as confectioners, preserve manufacturers, and brewers.

The members of the Committee now include the following :—

Sir George Beilby, Mr. R. F. Blair, Prof. M. J. R. Dunstan, Sir Richard Carton, Mr. T. H. P. Heriot, Dr. C. A. Keane (ex officio); Mr. Arthur R. Ling (Chairman of the Committee): Mr. J. W. Macdonald, Mr. G. Mathieson, Mr. C. Sandbach Parker, Mr. J. Pickering, Mr. R. Robertson, Mr. F. I. Scard, Mr. Louis Souchon, and Mr. A. J. Yorke.

A schedule of questions has been addressed to the various Dominions, Colonies, Dependencies, and Protectorates of the Empire, and the replies to these being now complete, it is proposed to bring a report before the annual general meeting of the Society next month. On this occasion, a congress on the supply and production of sugar within the Empire will be held at Clothworkers' Hall, Mincing Lane, E.C., on Wednesday, July 16, at 10.30 A.M.—1 P.M., and from 3 P.M.—5 P.M. The Earl of Denbigh has consented to preside over the meeting.

Probably no other article of dietary has shown such a marked increase in demand during recent decades as sugar. It is a significant fact that the British Empire exceeds all other countries in the production of sugar, whilst the United Kingdom, which holds the second place in the world as a consumer of sugar, imports more than 90 per cent. of this commodity from foreign countries. Before the war, the majority was derived from Europe, for the most part from Germany and Austria.

The possibilities of extending the production of sugar within the British Empire are enormous, and from the data obtained by the Committee there can be no doubt that with improved methods of cultivation and manufacture, the Empire can be made self-supporting as regards sugar, whilst the possibility is not excluded that it might also supply many more countries than it does at present.

The chief part of the Committee's work has been directed towards the problem of increasing and developing the supply of sugar in the British Empire beyond the seas. The bulk of this sugar is derived from cane. In addition to this however the possibility of producing sugar from beet in the United Kingdom has not been overlooked. The Committee is in possession of much data on this subject, and its collation should lead to a final answer on what has been hitherto a vexed question.

RECENT IRON-ORE DEVELOPMENTS IN THE UNITED KINGDOM.*

Whilst the basis of the prosperity of a country is admittedly agriculture, its industrial growth is founded on mineral resources, and its participation in the world's markets is chiefly dependent on the extent to which these raw materials can be applied to home manufactures.

It is true that the first historical reference to this country mentions the export of tin from Cornwall and that Great Britain's production and export of copper in the early part of the 19th century were the largest in the world; but for its modern industrial pre-eminence it is indebted to its *coal* and *ironstone*.

The cheap manufacture of iron and steel in this country was greatly aided by the providential dispensation that the ironstone was so closely associated in nature with the fuel required to smelt it that the factor of transportation was practically eliminated. But the gradual exhaustion of the richer blackbands and clay-ironstones of the Carboniferous formation, and the introduction of the Acid Bessemer process of steel manufacture, which requires a pure ore free from phosphorus and sulphur, made it necessary to find other sources of iron-ore supply. For many years the United Kingdom has been dependent, for 30% of the iron-ore used in its blast-furnaces, on foreign countries. Foreign ore plays even a bigger *rôle* than at first sight appears, since it averages 50% iron as against an average of 30% for home ores. The importation of hematite, rich in iron and low in phosphorus, from Spain and the Mediterranean, has built up the big iron industries that are engaged in the manufacture of steel by the acid process in South Wales, on the North-West Coast, on the North-East Coast, and in Scotland, where the ports of Cardiff, Port Talbot, Whitehaven, Barrow, Middlesbrough, Newcastle and the Clyde, situated in close proximity to an ample supply of labour, enable foreign ore and native coal to be easily assembled and cheaply handled.

Cheap water-transport is the basis of the success of the importation of foreign ore. Its importance may be illustrated by the development of the great iron and steel industry of the United States. In that country the ore is brought in 10,000-ton boats from the north end of Lake Superior, where it occurs in great abundance, to Chicago and Pittsburg, where there are ample supplies of fuel and labour. In 1916 as much as 64 million tons of iron-ore was conveyed in this manner.

In the case of the United Kingdom, ocean-transport was found to have its drawbacks when the war broke out; and the scarcity of ship-tonnage, which resulted from the activity of the enemy submarines, raised the cost of imported ore from about 20*s*. (at which Best Bilbao ore ruled in British ports in 1914) to an actual price of over £6 per ton, although, under the cloak of Government subsidies, it figured at a lower level. At one period of the war the supply from these sources threatened to be cut off altogether.

To meet this situation an increased development of the Jurassic ironstones of this country was decided on. These ironstones, although abundant and cheaply worked, are what the ironmasters term "lean," that is to say they are low in iron, averaging only 28% of that metal. Moreover, they have a high phosphorus and sulphur-content and, for the most part, are rather siliceous.

In this place it may be well to recall that there

* A lecture delivered by Dr. F. H. Hatch at the Royal School of Mines on May 27, 1919.

are two classes of steel, which are named "acid" and "basic" respectively, according to the process used in their manufacture. Acid steel is produced from hematite pig-iron, practically free from phosphorus and sulphur, in furnaces provided with a siliceous (or acid) lining. Basic steel, on the other hand, is produced from pig-iron containing both these injurious ingredients, which are removed in the course of manufacture by means of a basic lining to the furnaces. The large increase in the production of phosphoric ores was reflected in the increased output of basic steel.

This increased production raised many difficult problems. In the first place it necessitated a different metallurgical treatment, involving, as already explained, the substitution of basic-lined steel furnaces for those of the acid type, with consequent increased supplies of suitable refractory materials. It also involved large additional supplies of fuel for smelting and of limestone for fluxing the ore in the blast-furnaces. Difficulties arose with regard to the supply of magnesite and magnesite bricks. Prior to the outbreak of war the magnesite brick industry was almost wholly in the hands of the Austrians. The Austrians possess in their own country extensive deposits of magnesite peculiarly suited for brick-making, and they have devoted both skill and money to the perfecting of their products, with the result that before the war they commanded practically the entire custom of the steel trade of this country. To make up for the loss of this Austrian material, arrangements were made by the Ministry of Munitions for the manufacture in this country of magnesite bricks, and the raw material was obtained from Euboea in Greece and from Salem in Madras. To furnish the required dolomite and limestone new quarries were opened up in this country.

With regard to labour a new supply had to be found not only to work the new quarries of ironstone, limestone, dolomite, etc., but also to build railways required to open them up, to erect extensions to existing plant, to man the new works, to re-line furnaces, etc., and this in face of the incessant and urgent calls of the Army to fill the gaps in the fighting line. Considerable use was made of prisoner labour. The difficulty with prisoners was to induce them to work. On account of the Army regulations work could neither be compelled by force, nor by a reduction of rations. The difficulty was overcome by the introduction of piece-rates; but only to a limited extent, as there was no outlet for surplus earnings in the canteens, food-supplies having been cut down on account of the general food shortage. The lack of quarrymen led to active steps being taken in responsible quarters to supplement and to increase the efficiency of manual labour at the quarries by the provision of mechanical appliances for stripping, breaking and loading the ironstone. In these open-workings, the output per man employed varies with the thickness of the ironstone bed, the amount of cover to be removed, the use made of mechanical appliances, and the condition of the weather. The weather materially affects the output, especially where hand-labour is concerned. From returns made to the Ministry of Munitions in December, 1917, it appears that the average output in the Midlands per man employed was 5 tons per shift, and that it ranged from 3·8 tons, where hand-labour was alone employed, to over 15 tons where mechanical excavators were in use under favourable conditions. The actual saving of manual labour which resulted from the installation of mechanical plant in the ironstone quarries during the war is estimated to have been equivalent to over 3000 men.

The Jurassic ironstones have a wide distribution both in this country and on the continent. In 1913 Germany mined, in Lorraine and Luxemburg, 28 million tons of Minette ores of Jurassic age, out of a total production of 36 million tons of iron-ore, while she imported in addition 3,800,000 tons of the same ore from Briey. Without the Lorraine iron-ore basin, which she took from France in 1871, Germany would have been unable to go to war, and she took care to secure the remaining portion of the field (*i.e.* the Longwy and Briey basins) soon after the commencement of hostilities. One of the best guarantees for future peace is the provision in the Peace Treaty that no portion of this iron-ore field shall remain in German hands.

In England the Jurassic formation stretches as a broad band from the coast of Yorkshire to that of Dorset. The ironstones occur on four different horizons:—

THE JURASSIC IRONSTONES.

Name of Ironstone Bed	Position in Jurassic System	Where worked
Westbury and Dover	Corallian ...	Not yet worked for iron
Northampton Ironstone	Lower part of the Inferior Oolite	Rutlandshire and Northamptonshire
Marlstone	Upper part of the Middle Lias	Cleveland in Yorkshire, South Lincolnshire, Leicestershire and Oxfordshire
Frodingham Ironstone	Middle part of the Lower Lias	North Lincolnshire

The Corallian ironstones are at present not worked as a source of iron, although the Westbury bed is quarried for use in the purification of illuminating gas. In the Kent coalfield a bed of oolitic ironstone, 16 feet thick, has been cut in the shaft of the Dover Colliery, at a depth of 593 feet from the surface. This stone contains, as mined, 33% of iron, 15% of silica, 9% of lime, 0·45% phosphorus and 0·05% of sulphur. With regard to mechanical condition, it is rather friable and may have to be sintered or briquetted before use in the blast furnace. On account of its favourable situation in a coalfield and on the sea-board it is most probable that steps will be taken to work this deposit in the near future.

The other Jurassic ironstones are all worked; and in 1917 accounted for over 80% of the total output of iron-ore in the United Kingdom, the remaining 20% being made up of hematite mined in Cumberland and Lancashire (10½%), blackband and clay-ironstone mined in the English and Scotch coalfields (8%) and sundry ores mined in Wales, Forest of Dean, Devonshire, Weardale and Ireland (1½%).

Taking the Jurassic ironstones in descending order the proportion in which they were worked (in relation to the total production of the United Kingdom) in 1917, and their iron-content are as shown in the table:—

Table showing relative production and iron-content of the Jurassic Ironstones.

Ironstone	Ratio to total production Per cent.	Average-iron-content (as mined) Per cent.
Inferior Oolite (Northampton and Rutland)	21	32
Middle Lias (Cleveland) ...	32	28
Middle Lias (South Lincolnshire, Leicestershire, and Oxfordshire)	9	25
Middle Lias (Raasay)	0·5	23
Lower Lias (North Lincolnshire)	18·0	23
	80·5	27·6

The average composition of the different Jurassic ironstones is shown in the following table:—

Table showing average analyses of Jurassic Ironstones as received at the works.

	Inferior Oolite (Northampton) Per cent.	Middle Lias (Cleve and Var) Per cent.	Middle Lias (Leicester Var) Per cent.
Fe ...	32·5	2[illegible]·1	25·2
Mn ...	0·24	0·11	0·23
SiO_2 ...	11·7	11·8	10·9
Al_2O_3 ...	6·1	10·2	8·0
CaO ...	2·7	4·7	9·6
MgO ...	0·4	3·5	0·6
S ...	0·10	0·26	0·11
P ...	0·60	0·47	0·25
Water (combined) ...	15·2	6·8	16·4

	Middle Lias (Oxfordshire Var) Per cent.	Lower Lias (Frodingham Stone) Per cent.	Corallian (Dover Colliery) Per cent.
Fe ...	24·0	22·7	33
Mn ...	0·27	0·96	—
SiO_2 ...	10·2	8·1	15
Al_2O_3 ...	7·6	5·1	—
CaO ...	12·2	18·2	9
MgO ...	0·6	1·0	—
S ...	0·06	0·16	0·05
P ...	0·23	0·31	0·45
Water (combined) ...	15·6	10·7	—

The Northampton ironstone is, in general, high in silica and low in lime, and contains 0·1% of sulphur and 0·6% of phosphorus. In part, it is smelted locally with limestone or with limey ironstone, obtained in the district, to neutralise its siliceous character. Some is sent to Frodingham and some to Middlesbrough for smelting with the ironstones of those districts; but the greater proportion goes to furnaces in the coalfields of Staffordshire, Derby and Nottingham, South Yorkshire and South Wales to be smelted in admixture with the calcareous blackband and clay-ironstones of the coal-measures and with tap-cinder.

The Cleveland ironstone is also siliceous and requires lime to flux it. It is high in alumina and sulphur and this feature militates against its use for making basic pig-iron, since the alumina-content makes it difficult to carry sufficient lime in the slag to ensure the production of a basic pig low in silicon and sulphur. To produce a suitable pig a considerable proportion of ores low in alumina, mainly of foreign origin, has to be added to the furnace charge. But, by using molten metal direct from the blast furnace and desiliconising it in a mixer, basic open-hearth steel can be made from Cleveland ores without admixture with foreign ores.

The Frodingham ironstone almost invariably contains sufficient lime to be fluxed without the addition of limestone. It also carries about 1% of manganese and can therefore be smelted without the addition of manganese ore. These self-fluxing properties make it a most valuable ore, in spite of its low iron-content which averages only 22%. The sulphur-content is 0·16% and the phosphorus, 0·31%.

The Marlstone of South Lincolnshire, Leicestershire and Oxfordshire is on the whole a "limey" ironstone and is often self-fluxing. In places, however, where the surface waters have leached out the lime, it is siliceous. Its phosphorus-content averages 0·25%; sulphur, 0·1%.

The following are average analyses of the limey and siliceous varieties, respectively:—

	Limey Ironstone (Unweathered marlstone) Per cent.	Siliceous Ironstone (Weathered marlstone) Per cent.
Fe ...	22.13	27·91
Mn ...	0·24	0·28
SiO_2 ...	9·39	13·28
Al_2O_3 ...	7·36	8·03
CaO ...	11·89	3·79
MgO ...	0·61	0·42
S ...	0·06	0·05
P ...	0·23	0·22
Moisture ...	13·85	20·56
Difference (combined water, CO_2 and O)	30·94	25·46
	100·00	1 0·00

It will be seen that chemically the change from the limey to the siliceous type, brought about by weathering, consists of a loss of lime and carbon dioxide and an increase of all the other constituents—iron, silica, alumina and moisture. Physically, the change is from a compact bluish-green ironstone, consisting of carbonate of iron and lime, to a porous brown hydrated oxide of iron, or limonite. In the quarries the horizontal line of demarcation between the two varieties is often clearly discernible. Where, however, the "cover" consists of clay, shale or other impermeable material of sufficient thickness to hinder the downward percolation of the surface water, hydration and oxidation of the ironstone is prevented, and the green limey variety in that case extends up to the junction of the ironstone with the cover.

Before charging into the blast furnaces, the ironstone of all the districts is usually calcined, although a certain proportion is fed raw into the furnaces. The object of calcining, in the case of the oxidised stone, is to eliminate the water; in the case of the green carbonate stone, the effect is to drive off the carbon dioxide and convert the iron to peroxide. The loss on calcination is roughly 25% of the weight. Consequently, calcination at the point of origin saves railway carriage. It has the disadvantage, however, on the one hand, that exposure to the weather may result in the calcined material absorbing a considerable amount of water on its journey to the furnaces, and, on the other, that the handling and transportation of the dry material may engender a considerable quantity of dust, which is objectionable to the men engaged in its discharging, and tends to choke up the furnaces.

Calcining raises the percentage of iron considerably. If the loss on calcination is 25%, the increase is one-third of the percentage of iron in the raw stone. Thus, the 32·5%, which is the average iron-content of the raw Northampton stone, becomes 43% in the calcined material; the 28% of the Cleveland stone becomes 37%; the 24% of the Oxfordshire stone 32%, and so on. It follows that the use of calcined stone increases the output of pig iron per furnace. Furthermore, there is a saving of fuel in the blast furnace.

The calcining is either effected in Gyers, or Davis Colby kilns, with or without forced draught, or in the open heaps, or "clamps," as they are termed in Northamptonshire. It is a slow roasting process, and the fuel required is about 1½ cwt. of coal to the ton of ironstone.

The Jurassic ironstones, although poor in iron, are valuable because of their considerable thickness and widespread occurrence at only a slight depth below the surface. With the exception of the Cleveland District of Yorkshire, where the ironstone is now mined underground, the workings are nearly everywhere at the surface, the ironstone being quarried after stripping off an overburden of soil, sand, or clay as the case may be. Since the angle of the dip is usually small, or, in other words, th

beds are practically horizontal, considerable areas can be worked before the overburden becomes too great for removal at a reasonable cost. As much as 60 feet of soft material (sand or clay) can be removed, and under favourable conditions probably 100 feet will be removed.

The different beds of ironstone vary considerably in thickness. The thickest is the Frodingham bed in North Lincolnshire. This ironstone is 25 to 30 feet in thickness, and consequently can be worked very cheaply by mechanical excavation. Before the war, the cost of the stone in wagons at the quarries (exclusive of royalty) was not more than 1*s.* per ton. Probably it is double that now.

The workable part of the Northampton ironstone varies from 6 to 13 feet, averaging about 8 feet. The lower portion of the bed is generally too poor in iron for economic extraction. During the early part of the war it was sold at 3*s.* 3*d.* per ton of raw stone. Subsequently, the price was fixed at 3*s.* 9*d.* per ton, plus ½*d.* for every 1*s.* 3*d.* rise in wages above the rate current on November 12, 1917.

The Cleveland Main Seam varies from 5½ to 12 feet. It is mined at depths ranging from 100 to 600 feet, the mines being worked on the bord and pillar system. The cost of the stone at the pit's mouth is now about 10*s.* per ton, as against 2*s.* to 4*s.* for the quarried stone. The output per man employed on surface and underground in the Cleveland mines averages 2·2 tons per shift as against 4 to 15 tons for the quarried stone. In addition to the Main Seam, other ironstone beds, both above and below it, have from time to time been worked on a small scale in the Cleveland District. Their geological relation to the Main Seam is shown in the following table:—

IRONSTONES OF THE CLEVELAND DISTRICT

Geological Formation	Name of seam	Thickness of seam, feet	Thickness of intervening strata, feet
Inferior Oolite	Top or Oolite seam ...	4—9	
Upper Lias ...	Strata ...	...	260
	Main seam...	5½—12	
Middle Lias ...	Shale ...	...	2—6
	Pecten seam	1½—6	
	Shale ...	...	3—7
	Two-foot seam ...	1½—2½	
	Shale ...	...	20—30
	Avicula seam	0—3	

As compared with 1916 figures, the production of the Jurassic ironstones as a whole was increased by 45,000 tons per week, equivalent to 2¼ million tons per annum. The increase reached this maximum in the first half of the year 1918. But it was not possible to maintain production at that figure on account of the calls of the Army on labour. The increase was made mainly in Northampton, Rutlandshire and Leicestershire, the quarries in these counties accounting for 59% of the total increase; but Cleveland accounted for 26% and Oxfordshire for 9%.

The following table, showing the production of the Jurassic ironstone in relation to the total production of iron ore in the United Kingdom during 1918, is compiled from returns made to the Ministry of Munitions.

PRODUCTION OF IRON ORE IN THE UNITED KINGDOM DURING 1918.

	Tons	
Cleveland	4,570,892	
North Lincolnshire ...	2,639,712	
Midlands	4,954,087	
Raasay	88,047	
Total Jurassic Ironstones ...		12,252,738 (80%)
Coalfields	1,119,215	
Wales and Forest of Dean	85,419	
Miscellaneous (Ireland, County Durham and Devonshire)	37,039	
West Coast (Hematite) ...	1,549,962	
Total non-Jurassic ores ...		2,791,635 (20%)
Grand total ...		15,044,373

With regard to the non-Jurassic iron ores of this country, the most important are the hematite deposits of Cumberland and Lancashire. These ores are remarkable for their richness in iron and their freedom from both phosphorus and sulphur, and they therefore furnish a pig-iron very suitable for the Acid Bessemer process, and yield an exceptionally pure steel. They are consequently in great demand; and this demand was emphasised during the war by the difficulty at one time experienced in securing sufficient supplies of hematite ore from Spain. Every effort was therefore made to push production to the utmost, and many abandoned mines were re-opened in order to extract the pillars.

The deposits occur as masses of irregular shape in the Carboniferous Limestone, a formation which in this district rests uncomfortably on the old Skiddaw Slates, and is itself concealed in places by overlying Coal-measures and Red Sandstones, or by Boulder Clay. The existing mines are situated between Lamplugh in Cumberland and Ulverston in Lancashire, a distance, from north to south, of 35 miles.

No doubt, besides the known deposits, many undiscovered ore-bodies exist in the Carboniferous Limestone, that can only be found by systematic prospecting by boring. Already before the war, borings through the Red Sandstones had disclosed, south of Egremont, some of the largest ore-bodies that have been found in either county, with the possible exception of that worked by the Hodbarrow mine. The Beckermet, Ullcoats and Ullbank Companies are now engaged in developing and working these deposits.

Since the Carboniferous Limestone is of widespread occurrence in the United Kingdom, it might have been expected that valuable hematite deposits would have been discovered in other parts of the country. With the exception, however, of deposits of limited extent in South Wales and in the Forest of Dean, this has not proved to be the case. The South Wales hematite was worked fairly extensively to the north-west of Cardiff between the years 1840 and 1870, and yielded in the aggregate some 3 million tons of ore. But with the exception of the Llanharry mine, which still continues to produce about 60,000 tons of ore per annum, all work has stopped on these mines.

In the Forest of Dean the deposits, or "churns" as they are locally called, are chiefly characterised by their irregularity and small dimensions. The output of this field is quite unimportant, being less than 300 tons a week.

The only other important sources of iron ore in this country are the blackband and clay-ironstones, associated with the coal seams in the English and Scotch coalfields. These ores, which once played a big *rôle* in the British iron industry, are now of small importance owing to the exhaustion of the larger and more profitable seams.

The total output from Scotch and English coalfields amounts to 1,120,000 tons per annum, of which 357,000 tons come from Scotland and 695,000 tons from North Staffordshire. In Scotland the ore is derived from narrow seams of blackband and clayband and from "balls" of ironstone brought down in working the coal.

In North Staffordshire there are (1) small

VIEWS OF DEVASTATED FACTORIES AT CHAUNY, FRANCE

Fig. 1.
Approach to the chemical works of the St. Gobain Company at Chauny.

Fig. 2.
Wrecked factory where plate-glass was polished.

Fig. 3.
Remains of the caustic soda factory.

Fig. 4.
Wreckage at a sugar refinery in Chauny.

Fig. 5.
Wrecked boilers and boiler house.

Fig. 6.
Ruins of pyrites kilns and Glover tower.

seams of blackband associated with sufficient combustible material to permit of calcination in the open without the addition of further fuel, and (2) seams of clay-ironstone which require the addition of fuel for calcination. By the calcination of these ironstones two products are obtained, (1) a high-grade material, containing over 60% iron, which is used for bottoming and fettling puddle-furnaces and for oxidising purposes in the steel furnaces; and (2) a slightly inferior quality containing 55% of iron which goes to the blast furnaces.

In the industrial recuperation of this country now that the war is over, the working of the low-grade Jurassic deposits which it is fortunate in possessing is destined to play a great part. This has been rendered possible by the great extensions to iron and steel works that have been initiated with Government assistance during the war. These works have been planned on the most modern lines, and possess on the same site by-product coke ovens, blast furnaces, steel works and rolling mills. They are designed for the basic process of steel-making and will be fed with home ores. In choosing the sites for these works regard has been paid to the situation of the raw materials—ore, fuel and flux—required to supply them. On the completion of these extensions there should be no necessity for this country to import a single ton of foreign steel. Before the war something like 2½ million tons of steel, in the form of slabs, blooms and billets, were imported into this country annually, mainly from Germany.

But for success in this great undertaking cheap ore and fuel are essential, and these can only be obtained, in face of the greatly augmented cost of labour and material, which is a legacy of the war, by an all-round increase in efficiency, embracing capital, engineering and labour—capital by the installation of up to date equipment, engineering by improved mining methods, and labour by an increased output per man per shift.

These are the problems of the immediate future that await solution.

SOME DEVASTATED FACTORIES OF FRANCE.

W. F. REID.

After the meeting of the Inter-allied Conference of Chemical Societies at Paris in April, a visit was paid by the delegates to the devastated regions of Chauny, Tergnier and St. Gobain (this J., 1919, 142 R). During this visit some interesting photographs were taken by Mr. Edwin Thompson, one of the delegates of the Society of Chemical Industry, which show in a graphic manner the deliberate and calculated destruction wrought by the Germans while they occupied this section of industrial France.

One of the chief factories destroyed was the celebrated chemical works of the St. Gobain Company, the approach to which is through the now ruined town of Chauny (fig. 1). The first plate-glass was made on the large scale at St. Gobain in 1693, the invention of the process being attributed to Abraham Thévart and Lucas de Nehou, who made their experiments at the rue de Reuilly, Paris. The ancient Romans, however, made rough plate-glass by casting; there are samples of glass sheets made in this way in the museums of Pompei and Reading. The plant destroyed by the Germans here was on a very extensive scale, being capable of turning out sheets of polished plate-glass 27 feet long and 12 feet 6 inches wide. The more portable parts of the machinery were stolen and the remainder wrecked by charges of explosive, as shown in fig. 2.

Wired plate-glass was made here by Appert's process, and the way in which this glass resisted the effects of the explosions bore eloquent testimony to its utility. Among the ruins lay tangled masses of fine steel wire upon which beads of various colours were threaded. In the manufacture of beads, as formerly carried on, pieces were cut off small glass tubes of diameters corresponding to the size of the beads. The pieces of tube thus obtained were rounded off by revolving them at a red heat in a mixture of powdered lime and charcoal. Apparently the St. Gobain beads were supported on steel wire during the heating, giving them a very brilliant surface.

Many of the buildings had been cleared of all machinery before they were destroyed, and so thoroughly were these depredations organised, that a railway was built into the factory by the Germans. Where the plant was not worth removing the whole factory was wrecked by a charge of explosive, as shown in fig. 3. In the case of power plants the boilers were rendered unfit for use either by explosive charges detonated inside them or by larger charges underneath them which destroyed both boilers and boiler house. The latter case is illustrated by fig. 5 where the boilers had just been inspected by our President, Prof. H. Louis, when the photograph was taken.

In the destruction of the chemical factories at Chauny German experts and manufacturers assisted, and pointed out the most valuable and least easily replaced portions of the plant belonging to their French competitors. It was at Chauny that the first commercially successful plant for working the Leblanc soda process was erected, and the factory continued working until destroyed by the Germans. Nicolas Leblanc obtained on September 25, 1791, a patent for working his process. The Duke of Orléans, better known as "Philippe Egalité," advanced sufficient money to build a small factory at St. Denis, Paris, which was called "La Franciade." In 1793 the Duke of Orleans lost his head and La Franciade was taken over by the State, but proved unsuccessful. Afterwards the process was started at Chauny, and the neighbouring factory of St. Gobain exhibited glass made with Leblanc soda in 1806, the same year in which poor Leblanc committed suicide in his ruined factory.

The caustic soda factory at Chauny appears to have aroused especially malevolent feelings in Teutonic breasts. Fig. 3 shows the present condition of what plant remains, and this photograph is interesting because the farthest to the right of the four persons in the background is M. Paul Kestner, President of the Société de Chimie Industrielle of France, and he is standing upon the shattered remains of a Kestner evaporating plant. The brick rubbish in the foreground has been broken up as a first step towards making concrete for reconstruction purposes. Portland cement for this purpose is, however, lacking, and hydraulic mortar is necessary for foundations, as the factory is situated on the low banks of the Oise. One of the British delegates was able to point out that the Romans, on their arrival in Britain, lacked the hydraulic materials to which they had been accustomed in Italy, and found a substitute in powdered brick. It would only be necessary to pulverise a portion of the bricks finely to render the lime mortar hydraulic.

Fig. 6 shows some ruins of sulphuric acid plant. There the Gay-Lussac towers were originally erected. Gay-Lussac was consulting chemist to the St. Gobain Co. at Chauny in 1827, when he invented his tower, and, at a later date, he became a director of the company. The first tower was erected at Chauny in 1842. Two years later the tower was introduced into a Glasgow factory. Those who have had an opportunity of witnessing

the wanton havoc wrought by people who call themselves civilised will feel no desire to co-operate with such people again, and the establishment of the Inter-allied Confederation will be welcomed by all who wish to prevent in future the prostitution of science to the will of barbarians.

COST ANALYSIS IN CHEMICAL MANUFACTURE.

PART II.

COSTS AND EFFICIENCIES OF NITRIC AND SULPHURIC ACID PRODUCTION.

Any attempt to summarise the great mass of data incorporated in the "Reports on Costs and Efficiencies for H.M. Factories" would be fruitless, for the information given therein does not admit of condensation. It must suffice, therefore, to indicate the principles and methods involved by selecting material from two of the more important sections of the Second Report.

Nitric Acid Production.

In calculating the comparative costs of nitric acid production, sodium nitrate is charged at £24 per ton $NaNO_3$, and sulphuric acid at £7 per ton H_2SO_4. The first graph presented shows the comparative costs per ton HNO_3 produced for nine Government plants, one British trade factory and two Canadian factories for the months of May and June, 1918. It makes possible an immediate comparison not only of the total costs, but also of the several items which go to make them up—*i.e.* the raw materials usages, and the charges for labour, fuel, water, steam and power, maintenance and general services—so that it is clear where extravagance or economy occurs. The value of comparative cost analysis at once becomes plain. The results thus summarised graphically are commented on in the text. Here also tables of costs are given for each of the various factories for successive periods, so that it can be seen how each factory has been progressing. These results, again, are summarised in a graph (graph 1A), where three or in some cases four successive six-monthly periods are given for the several factories, together with the average working of all the factories for each period. For the most recent six-monthly period, January—June, 1918, data are given for nine Government factories. One of these factories, however—namely, Greetland—was producing nitric acid of only about 65 per cent. strength, so that, although its costs are most remarkable, this fact should be borne in mind when comparing them with those of the factories making stronger acid. Figures are tabulated below showing production, plant efficiencies, and raw materials usage, services and total cost per ton of product. The graphs (which are not reproduced here) further show the amounts of the total service charges assignable respectively to labour, fuel, water, steam and power, maintenance and general services, and these are discussed in the text. It is noticeable that in costs for a six-monthly period there are fewer striking variations than in monthly costs, where a charge such as, *e.g.*, maintenance, under which would come renewal of retorts, might be much heavier in some months than in others.

In the table below it is seen that for the period January—June, 1918, Gretna is cheaper than both Pembrey and Queen's Ferry, but the cost at Greetland is nearly £1 lower than at Gretna. The two highest costs given in this table appear to be for closing down periods, and this probably explains the high service charges. The best efficiency for the complete six months is 94·8 per cent. for Gretna, followed by Queen's Ferry TNT Retorts with 93·5 per cent. and Greetland with 93·3 per cent. The best H_2SO_4 usage is 1·348 tons at Greetland, whilst Gretna follows it very closely with 1·354 tons. (This points to economy in H_2SO_4 usage being compatible with high efficiency—a question which has been disputed. Nor would it appear, since service charges at Greetland and Gretna are also low, that this economy has affected the cracking of retorts.) Craigleith is very prominent as a heavy consumer of H_2SO_4. Necessity of avoiding any possible delay in discharging the retorts is cited as an excuse for this.

It is remarkable that the greatest difference between the best and worst factories in sodium nitrate usage amounts to only about £1.5, and in H_2SO_4 usage to only about £1.2 during this period, whilst the total service charges vary considerably. Attention is drawn to this, the most noticeable variations in the service charges allocated to maintenance, labour etc. being mentioned, and the fact emphasised that the average services for the six-monthly periods have been slowly but continually increasing, and so tending to counterbalance the improved usage in materials. Increased cost of labour must have been responsible in part for this increase, but nevertheless improvement is asked for here. Plant managers are thus given every opportunity of realising how they stand, and are put on their mettle both to improve on their own practice and to beat that of others.

It is interesting to note that the figures given in

COST OF PRODUCTION PER TON HNO_3.

January—June, 1918.

Factory	Production Tons NHO_3	Efficiency %	NaNO Usage	H_2SO_4 Usage	Services	Total
Queen's Ferry, NC (Jan.—May)	1449·0	94·2	1·433 tons £34·392	1·368 tons £9·576	£11·643	£55·611
Litherland (Jan.—May) ..	1909·25	90·6	1·489 tons £35·742	1·472 tons £10·304	£8·982	£55·028
Oldbury	8726	91·8	1·470 tons £35·290	1·492 tons £10·446	£8·272	£51·008
Craigleith	1131·68	90·7	1·489 tons £35·736	1·520 tons £10·637	£7·393	£53·766
Penrhyndendraeth	1100·9	90·2	1·496 tons £35·893	1·389 tons £9·720	£7·192	£52·805
Queen's Ferry, TNT ..	14832·2	93·6	1·443 tons £34·632	1·385 tons £9·695	£5·394	£49·721
Pembrey	7217·8	91·1	1·477 tons £35·480	1·379 tons £9·653	£4·062	£49·195
Gretna	8787·32	94·8	1·423 tons £34·152	1·354 tons £9·471	£5·125	£48·748
Greetland	1701·66	93·3	1·447 tons £34·723	1·348 tons £9·454	£3·728	£47·905

the report for the various six-monthly periods show that during June—December, 1916, 29,258 tons HNO_3 was made, while during January—June, 1918, the production was 45,154 tons. The average efficiency on the nitrate used was 87·6 per cent. for the former period as compared with 92·9 per cent. for the latter, whilst the H_2SO_4 usage was 1·578 tons for the former period as compared with 1·405 tons for the latter period. The saving shown in cost of raw materials (charged at the flat rates) amounts to £3.3 per ton HNO_3 produced, which would represent a saving during January—June, 1918, of £149,000. An increase appears in service charges, but as the cost of labour and stores had increased so enormously between 1916 and 1918 this could hardly have been otherwise.

Sulphur Trioxide Production.

The pure sulphur content of pyrites and brimstone is charged at £13 per ton. The graphs marked 2 and 2A included in this section make it possible to compare at a glance Mannheim, Tentelew and Grillo working. It is explained in the text that during the period January to June, 1918, considerable changes were made in the explosives programme necessitating the closing down of the Queen's Ferry, Gretna and Oldbury Mannheim plants and also of the East Greenwich Grillo plant. Mannheim costs are high, but it is well to remember that the speedy erection of these plants in the early days of the war tided over a critical period. At this time too little was known in England of the design and working of Grillo plant to admit of it being put speedily into operation, and importing oleum from America was both a costly and an unpleasant business.

The first graph represents the May, June and January—June, 1918, figures for each factory together with the average and bogey figures for these periods. Canadian Chamber plant, American Chamber plant and American Grillo plant costs also appear. Comments are made on the results shown in the graph; for instance it is pointed out that on the whole the American and Canadian plants appear to be inferior in technical working to the English plants though as regards service charges they score heavily. Tables are also given showing the detailed costs month by month for each factory. The following is that given for the Gretna Grillo plant:

June, 1916—June, 1917, the efficiency was 78·8 per cent., whilst the efficiency for January—June, 1918, was 91 per cent. Since the production of sulphur trioxide for January—June, 1918, was 52,817 tons, this improvement in efficiency would represent a saving of approximately 3600 tons of sulphur. It is true that the closing down of the Mannheim plants, previously mentioned, may partly account for this increase in average efficiency, but the great improvements effected are clear from consideration of the individual factories. Thus the efficiency of the Gretna Grillo plant was 86 per cent. for January—June, 1917, but 94·1 per cent. for January—June, 1918, and comparison of the service charges at Gretna for these two periods shows a decrease of 5*s.* per ton net SO_3. At the Oldbury Mannheim plant the efficiency was 76·1 per cent. during June—December, 1916, but 83·7 per cent. for July—December, 1917, whilst the service charges have decreased by more than £2 per ton net SO_3. A decrease in service charges is not however apparent in all cases—at Pembrey, for instance, there was a slow but steady increase; but in service charges economy is masked by the rise of wages and the price of stores.

It is clear from the whole report that maximum efficiency has been aimed at throughout. The shipping difficulty naturally made this imperative, but ordinarily it might pay to run a plant at an efficiency lower than the maximum.

Other subjects dealt with in the second report are:—denitration, distillation, concentration of sulphuric acid, TNT production, nitrocellulose production, nitroglycerin production, cordite, ether, calcium nitrate tetrahydrate, ammonium nitrate (by calcium conversion process and by ammonia-soda process), picric acid, tetryl, ammonium perchlorate manufacture, comparative costs of raising steam, costs of electric power and gas producers, overhead charges, and labour usage. Those interested in these subjects should turn to the documents themselves for information.* Not only will manufacturers find there stores of useful data, but, further, many will be impressed by seeing the help which can be gained by keeping technical records for each separate process and by analysing costs. An appendix to the first report, which is also reproduced in the second, describes very briefly the methods of calculation employed, but it is understood that the Factories Branch of Explosives Supply is about to issue shortly a full description of

GRETNA GRILLO.

Period	Net SO_3 made. Tons	Efficiency %	Equivalent pure sulphur		Services	Total
			Tons	Cost		
1917				£	£	£
January—June	8174·0	86·0	0·465	6·045	2·679	8·724
July—December	13166·3	91·7	0·436	5·668	2·943	8·611
1918						
January, 4 weeks	1947·2	92·4	0·433	5·627	2·673	8·300
February, 5 weeks	2742·3	94·6	0·423	5·498	2·194	7·692
March, 4 weeks	2071·0	93·9	0·426	5·538	2·488	8·026
April, 4 weeks	1954·8	94·2	0·425	5·520	2·318	7·838
May, 5 weeks	2150·8	95·0	0·421	5·475	2·322	7·797
June, 4 weeks	1476·2	94·5	0·423	5·499	2·625	8·124
January—June	12342·3	94·1	0·425	5·524	2·412	7·936

From this it appears that the efficiency continues at a very high level, and that service charges have been continually decreasing except in June—the slight increase here being explained as being partly due to a small reduction in output.

The graph 2A, reproduced overleaf, shows the cost at the factories for the various six-monthly periods. What stands out clearly in comparing the successive periods shown in this is the improved plant efficiency at each factory and the consequent economy in raw material usage. Looking at the overall averages, it is seen that for the statistical methods employed, which will form a supplement to these reports.† In conclusion the

* The second Report on Costs and Efficiencies for H.M. Factories controlled by Factories Branch, Department of Explosives Supply, can be obtained (price 7*s.* 6*d.*) from H.M Stationery Office or the usual agents.

The first Report is out of print, but the data included in it for the six-monthly periods up to December 1917 are reproduced in the second Report.

† The Report on the Statistical work of the Factories Branch, Department of Explosives Supply, is now in the press, and will shortly be obtainable from H.M. Stationery Office or the usual agents (probable price 3*s.*)

closing words of the introduction to the second report may be quoted. "It is hoped that when it is seen what enormous improvements have been effected at H.M. Factories by the aid of detailed analysis of efficiencies and costs, a new impetus will be given to the chemical industry in Great Britain, which will help it in the future to hold its own with chemical industry throughout the world."

NEWS FROM THE SECTIONS.

CANADA.

Ottawa Branch.

The annual meeting of the Ottawa Branch of the Society of Chemical Industry was held in Ottawa on May 9, 1919. The principal item on the agenda was the election of officers for the ensuing year. By unanimous vote Dr. Frank T. Shutt, who has ably conducted the affairs of the Society during the past year, was re-elected chairman, and the secretary, Mr. S. J. Cook, was also returned. A committee of five was elected, and the officers for the year 1919—20 are therefore: Chairman, Dr. F. T. Shutt; Secretary, Mr. S. J. Cook; Committee: Messrs. A. E. MacRae, E. Stansfield, R. E. Gilmore, M. F Connor, and F. J. Hambly.

After the election the members discussed the question of organisation among Canadian chemists, and made their plans in connexion with the Convention of Canadian Chemists held a week or two later. Delegates were appointed to represent the local branch at the Convention.

During the year 1918—19 the Ottawa Branch held seven meetings at which the total attendance was 249, the average being 36. Although the Branch has only completed its second year it now has on its roll 23 members of the Society, in and near Ottawa, and 21 associates of the local Branch, making a total of 44. It is hoped that the coming year will see this number augmented to about 65.

NEWCASTLE.

Prof. H. Louis was entertained at a dinner given by this Section on June 4, as an expression of appreciation for the good work he has done for the Society during his two years of office as President. The chair was taken by Dr. F. C. Garrett in the absence, through illness, of Prof. P. Phillips Bedson, the chairman of the Section.

MEETINGS OF OTHER SOCIETIES.

ROYAL SOCIETY OF EDINBURGH.

At the meeting held on June 2, Dr. John Horne in the chair, Dr. L. Dobbin read a paper "On the Presence of Formic Acid in the Stinging Hairs of the Nettle." The generally accepted view that formic acid is present in the stinging hairs of nettles is not convincingly established by previous investigations, in which nettles as a whole, and not exclusively the cell contents of the stinging hairs, were submitted to examination. The author has secured the collection of these cell-contents alone and the conversion of the free acid or acids which they contain into corresponding salts, by pressing the leaves of growing nettles between strips of the purest filter paper, previously impregnated with barium hydroxide or sodium carbonate and dried in air. The optical characters of the lead and barium salts prepared from the material so collected were examined by aid of the polarising microscope, and the various preparations were found to include crystals possessing the same characters as known specimens of lead formate and barium formate.

Samples of "Encysted Wood," presented by Colonel R. A. Marr, Norfolk, Virginia, U.S.A., were exhibited. This wood, obtained from the Balsa tree, is extremely light, its density being about half that of cork. Unfortunately it rotted easily in its natural state, but by a special process discovered by Colonel Marr a waterproofing mixture could be carried to the centre of any piece of timber coating the cells and ducts with an extremely thin permanent film. In this form the wood has been of great service in floating mines during the war.

THE ROYAL SOCIETY.

At the ordinary meeting held on June 5, Drs. E. F. Armstrong and T. P. Hilditch presented a paper on "A Study of the Catalytic Actions at Solid Surfaces." The authors have studied the rate of hydrogenation of a number of unsaturated fatty oils in presence of finely disseminated nickel, and expressed the results in the form of curves. These curves never approach the logarithmic type required for unimolecular action; in general they are very similar to those obtained in the case of enzymes, and they undoubtedly represent related phenomena. In each case the catalyst (enzyme or reduced nickel) unites primarily with the organic compound about to undergo change (hydrolyte or unsaturated glyceride), the complex so formed being decomposed by the other component of the interaction (water or hydrogen). In each case, moreover, action takes place entirely at the surface of colloid particles, and activity of the catalyst depends entirely on production of maximum surface and avoidance of impurities likely to destroy or dirty this surface.

It is considered that the interchanges take place in an electrolytic circuit in which the interacting substances are necessarily all comprised. Hydrogen and fatty oil are both to be thought of as coupled with nickel and interaction aa brought about through inclusion in the system of the electrolyte required to establish a conducting circuit. Both hydrogen and fatty oil are to be regarded as having some affinity for the catalyst, and the rate of change is to be considered as determined by the rate at which the less active (hydrogen) enters into productive association with the catalyst.

The Bakerian Lecture was delivered by the Hon. R. J. Strutt on June 19 on "A Study of the Line Spectrum of Sodium as Excited by Fluorescence."

The lecturer described an improved form of sodium vapour lamp, in quartz, which gives an intensely bright sodium spectrum, admirably adapted for exciting sodium vapour to resonance.

It is found that excitation of sodium vapour by the second line of the principal series leads to the emission of both λ3303 and the D line. On the other hand, as might be expected, excitation by the D line leads to the emission of the D line only, without 3303. If only one of the components of the doublet 3303 is stimulated, both the D lines are emitted.

When D light falls on sodium vapour, of appropriate density, it is known that an intense surface emission occurs from the front layer and a weaker one from succeeding layers. Analysis by absorption in an independent layer of sodium vapour shows that the superficial emission is more absorbable, and therefore nearer the centre of the D lines.

The breadth of the D lines in superficial resonance has been estimated by interferometer methods. It is found to correspond with the breadth conditioned by the Doppler effect, calculated on the assumption that the luminous centre is the sodium atom.

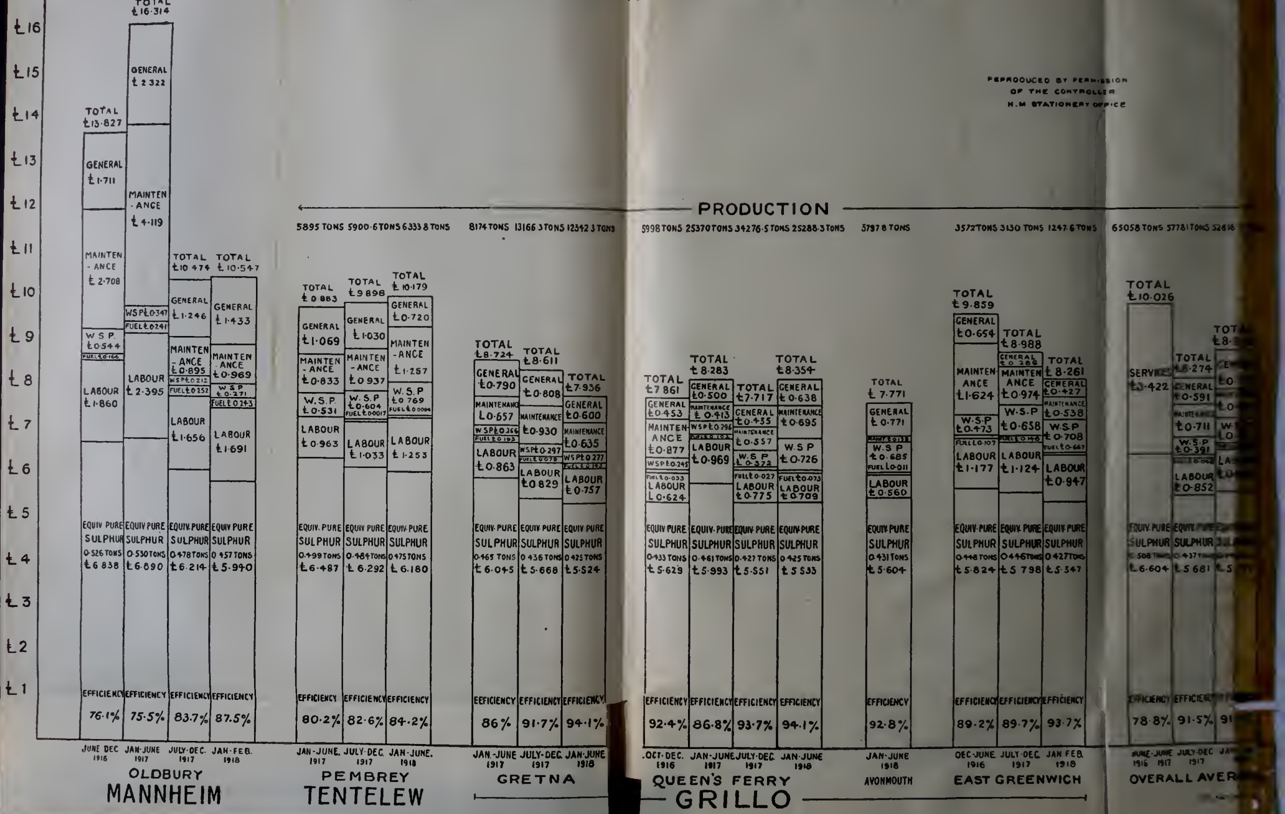
Polarisation could not be detected in the ultra-

2A

OLEUM

COMPARATIVE COSTS PER TON NET SO_3 PRODUCED

EQUIVALENT PURE SULPHUR IS CHARGED AT £13 PER TON.



violet resonance radiation, though, in accordance with previous observers, it was readily observed in D resonance.

THE CHEMICAL SOCIETY.

On June 5, with the President in the chair, Mr. P. Blackman read a paper on "An Isotonic (Isosmotic) Apparatus for comparing Molecular Weights." Two substances of known weights, w_1 and w_2, and of molecular weights, m_1 and m_2, are dissolved in the same solvent. One solution is placed in a porous, porcelain cell (test-tube shaped), the walls of which contain copper ferrocyanide as semi-permeable membrane. This cell is placed in the second solution contained in a wider and longer glass test-tube. After about 6 hours, osmotic flow between the solutions will have ceased, and the volumes, v_1 and v_2, of the two solutions are determined. The calculations are made from the formula $\frac{v_1}{v_2}=\frac{w_1}{w_2}\cdot\frac{m_2}{m_1}$. The porous cell is coated internally and externally, as to three-quarters of its length from the top, with paraffin wax to prevent the liquids creeping up. Good results were obtained with solutions of cane sugar.

The second paper was by Mr. V. Cofman on "The 'Active Substance' in the Iodination of Phenols." The author enumerated ten different methods of iodination and adduced evidence in favour of his claim that the halogen is conveyed to the phenol through the intermediation of hypoiodous acid, which in the course of the reactions decomposes into nascent iodine and iodate.

A brief summary by Prof. J. F. Thorpe of his investigations on the glutaconic acids, and on a new method of preparing glutaric acid, concluded the meeting.

THE BRITISH SCIENCE GUILD.

The annual general meeting was held at the Goldsmiths' Hall, E.C., on June 17. Sir Richard Gregory, in presenting the annual report, referred to the forthcoming second British Scientific Products Exhibition, which will be opened at the Central Hall, Westminster, on July 3, and for which the applications from exhibitors were sufficient to fill the allotted space four times over.

The presidential address was delivered by Lord Sydenham on "Science and Labour Unrest." The revolutions in the conditions of labour which the use of tools and the development of power to drive them had inevitably brought about, had led to widespread discontent, but science, which had unconsciously caused some of the evils, could now show the way to the restoration of national prosperity, viz., by greater economic use of power on a large scale and by more scientific management of industries. In increased production, and an excess of production over consumption, lay our only hope of recovering from the gigantic losses caused by the war and of securing higher standards of living and continuity of employment for manual workers.

Major-General Seely, the Under-Secretary of State for Air, said that the future development of aviation lay absolutely in the hands of scientific men, who were now called upon to devise means of securing greater safety in the air. He ventured to prophesy that within five years the two great difficulties of determining location and lateral and vertical declination would be solved.

Sir J. J. Thomson referred to the desirability of enabling the scientific men who had been working so successfully in the research departments connected with the Admiralty and the War Office, to continue work of a research nature. The spirit of research was now much more active in British industries, and the movement to form research institutes was full of promise, not only from the standpoints of science and of industry but also because of its ethical value. Alluding to the question of problems awaiting solution, Sir J. J. Thomson said that the discovery of the real cause determining the difference in behaviour between woollen and cotton goods when squeezed—the creases coming out from the former when the pressure is released, but not from cotton or calico—was of very great financial importance, although of singular complexity from a scientific point of view. According to an eminent scientist who had been associated with the fighting forces, the country had suffered greatly and unnecessarily during the war owing to ignorance of science among those in command. The cadets who passed well out of the Military Colleges constituted as a rule first-class material from a scientific standpoint, yet practically no subsequent use was made of their latent scientific ability. The Army, the Navy and the great Government departments generally stood in need of a strong infusion of men with true scientific training.

Major Sir E. H. Shackleton said that what struck him most on returning to civilisation was the great advance made by science during his absence. They left the cinematograph as a toy and came back to find it the fourth largest industry in the United States.

PERSONALIA.

Sir James Dewar has been awarded the Franklin medal of the Franklin Institute, Philadelphia.

Mr. S. H. Higgins has been appointed Head of the Research Department of the Bleachers' Association, Ltd.

Sir Henry Hadow has been appointed Vice-Chancellor of Sheffield University, and Prof. A. H. Trow Principal of South Wales University College, in succession to Prof. E. H. Griffiths.

Mr. J. E. Purvis has been appointed University Lecturer in Chemistry and Physics in their application to Hygiene and Preventive Medicine at the University of Cambridge.

Sir Frederick Black, President of the Institution of Petroleum Technologists, has resigned his office of Director of Navy Contracts, and has become a managing director of the Anglo-Persian Oil Co.

Mr. L. Guy Radcliffe, of the College of Technology and Hon. Sec. of the Manchester Section of the Society, has been awarded the Gold Medal of the Worshipful Company of Dyers for researches published in 1917-1918 on the sulphonation of fixed oils. He was assisted in this work by Mr. S. Medofski.

Among the members of the new committee recently appointed by the Government to inquire into the financial needs of university education in the United Kingdom are Sir J. J. Thomson, Sir J. J. Dobbie and Sir Dugald Clerk.

The Council of Liverpool University has appointed Dr. J. G. Adami as Vice-Chancellor in succession to Sir Albert Dale. Colonel Adami has occupied the Chair of Pathology and Bacteriology at the McGill University, Montreal, since 1892, and has recently been on active service with the Canadian Army Medical Corps.

The University of Manchester has bestowed the honorary degree of Doctor of Science upon Prof. J. C. McLellan of Toronto University, and upon M. Jean Perrin, professor of physical chemistry at the Sorbonne, Paris. The degree of M.Sc. Tech. has been conferred upon Mr. A. P. M. Fleming, Head of the Research Department of the British Westinghouse Co.

NEWS AND NOTES.

SOUTH AFRICA.

Salt.—At a recent conference of manufacturers, a representative of the South African Salt Owners' Association stated that the association had produced over 500,000 bags of coarse salt during last season, and that this quantity could be quadrupled if better means of transport were available. The country could be made self-supporting in regard to salt and its by-products if some system of light railways could be provided. The Association also considered it advisable to create an export trade in the southern hemisphere. It was thought that vessels returning to Australia, Japan, and East Africa might load salt at a low rate of freight or as ballast. The establishment of a central factory for the manufacture of by-products of salt was also considered necessary, and of scarcely less importance is the provision of storage at railway stations. The Association was further of opinion that the Government should impose an import duty on salt, and furnish such scientific assistance as would enable the industry to be run on the most up-to-date lines.—(*Official*).

Natural Soda on the Rand.—A rich discovery of natural sodium (and potassium) carbonate is reported from a property near Klerksdorp. A Johannesburg syndicate has acquired a large area of the deposits, and it is intended to begin development without delay.—(*Official*.)

Saldanha Bay Phosphate Deposits.—The extensive deposits of phosphatic rock occurring at Saldanha Bay are to be exploited. The mineral contains 14—16 per cent. of phosphoric oxide, 2 per cent. soluble in citric acid, and the price has been fixed at £8 15*s*. per ton, made up in bags of 200 lb. The material is to be worked up in a large factory at Johannesburg, where, it is anticipated, 2000—3000 tons per month of treated fertiliser will be turned out.—(*Bd. of Trade J., June* 5, 1919.)

Guano-Phosphate from Cape Cross.—The Government is receiving shipments of guano-phosphate from Cape Cross, which will be available for the forthcoming sowing season. The phosphate will be sold only to *bonâ-fide* farmers at £11 10*s*. per ton of 2000 lb., or 23*s*. per 200 lb. bag, delivery free on rail at Capetown, or on board ship at Table Bay Docks.—(*S. Afr. J. Ind., April*, 1919.)

Mica.—Shipments of South African mica to Great Britain have been so small that no regular market has yet been established. Care in production, and favourable shipping rates, would secure a regular market in the United Kingdom.—(*S. Afr. J. Ind., April*, 1919.)

Nitric Acid and Nitrates.—Nitric acid is used in South Africa chiefly for the production of nitroglycerin, gun-cotton and collodion cotton. This acid is also employed to dissolve copper from the gold-copper mixture precipitated by zinc from cyanide solutions in the treatment of the cupriferous gold ore from the Pilgrim's Rest district. The production of the three explosive works—Kynoch, Ltd., the Cape Explosives Works, Ltd., and the British South African Explosives Co., Ltd.—is about 18,000 tons. The total invested capital is not known, but the cost of the nitric acid plant of the Cape Explosives Works, Ltd., was about £37,000. Owing to lack of water power and to the fact that nitrates are imported duty free, there is little prospect of the successful manufacture of synthetic nitrates in South Africa. For explosives, however, nitric acid will continue to be manufactured locally from imported Chilean or synthetic nitrate, because importation of the acid is dangerous and expensive, and in addition there is a 20 per cent. *ad valorem* duty on the imported acid (with a rebate of 3 per cent. on that produced in the United Kingdom).

Barium nitrate, made from imported barium carbonate, forms an ingredient of the fuse-igniter composition used in the Transvaal mines. Lead nitrate is used to produce lead-zinc couples to facilitate precipitation of gold from cyanide solution, and is added to solutions or ore under treatment to precipitate soluble sulphides which interfere with the process. It is manufactured by the explosives works from lead derived from the Rhodesian Broken Hill mines.—(*S. Afr. J. Ind., April*, 1919.)

BRITISH INDIA.

Soil Surveys.—One of the important undertakings of the Board of Agriculture is the systematic surveys of soils in the different provinces. In Bengal considerable progress has been made with the provincial soil survey. Red soil shows a deficiency in phosphoric acid and lime in western Bengal and of potash in eastern Bengal. The soil survey is not limited merely to the analysis of soils, but the contents of ashes of the typical crops grown in each district are examined and recorded. Thus it is possible to determine the exhaustion of valuable soil constituents by the plants. As an instance, it is pointed out that in north Bihar the indigo soils have undergone deterioration owing to the depletion of phosphatic constituents (this J., 1919, 119 R).

Apatite.—Large deposits of apatite have been found in India, and it has been suggested to use it for enriching Indian basic slag which is of very low phosphatic content. Considerable work has been done by the Board of Agriculture in determining the solubility of the apatite and rendering it useful as a fertiliser. It has been shown that the large percentages of iron in Indian apatite restricts its use in the manufacture of superphosphate. It is suggested by the Board of Agriculture that cheap electric power, which will be available at the Tata Hydro-electric Works, particularly by its Koyna power project, would render it feasible to utilise these natural phosphate minerals as a source of soluble phosphate. The use of Palmer's patent has been suggested in this connexion.

CANADA.

A New Research Organisation.—The Shawinigan Water and Power Co., Montreal, is establishing a new research department to correlate the work being carried out in its various departments and to undertake new investigations on the manufacture of magnesium alloys, and on a number of other electro-chemical and metallurgical processes. Synthetic organic compounds based on calcium carbide manufacture and the production of acetic acid form the non-metallurgical field of this company. The development of Shawinigan Industries has been of great value during the war and the above company is now opening a branch in England.

The Canadian Institute of Chemistry.—At the first meeting of the Council of the new Institute, Prof. J. W. Bain, at present on the Canadian War Mission at Washington, and head of the Chemical Engineering Department of the Faculty of Applied Science, University of Toronto, was elected chairman. Three Vice-Presidents were chosen, as follows:—Dr. G. Baril, M.D., Laval University, Montreal; Dr. A. McGill, Department of Trade and Commerce, Ottawa, and Dr. R. D. MacLaurin, of the University of Saskatchewan, Saskatoon. Mr. Harold J. Roast, of Montreal, is the acting Secretary-Treasurer of the Institute.

Ten members were chosen to form an Executive:—Prof. E. G. R. Ardagh, University of Toronto; Dr. J. S. Bates, Price Bros. Ltd., Kenogami, Que.; Dr. H. E. Bigelow, Mount Allison University, Sackville, N.B.; S. J. Cook, Trade and Commerce, Ottawa, Ont.; J. A. Dawson, Trade and Commerce,

Vancouver, B.C.; I. Grageroff, Canadian Explosives, Montreal, Que.; Dr. L. F. Goodwin, Queen's University, Kingston, Ont.; Prof. A. Lehman, University of Alberta, Edmonton; Prof. E. Mackay, Dalhousie University, Halifax, N.S.; Prof. M. A. Parker, University of Manitoba, Winnipeg, Man. The new Institute is finding ready support and the James Robertson Co. Ltd., of Montreal, has started with a subscription of $500 to a general fund for carrying on the work. Offices have been opened in the Kingdom Building, Beaver Hall Hill, Montreal, Quebec.

Maple Sugar.—Reports from various maple districts in Eastern Canada state that the maple products this year will beat all records for the last ten years. The makers of maple sugar and syrup in Canada exceed 45,000. About 550,000 acres of land is being reserved in its natural wooded state, of which two-thirds is situate in Quebec, and the Eastern Townships of this province constitute the centre of the world's supply of maple products. Maple syrup is not exported on a large scale.—(*Official.*)

British Columbia.

Natural Deposits of Salts of Magnesium and Soda in British Columbia.—Several companies are interested in developing certain lake deposits of magnesium and sodium salts in this province. These salts as they occur in British Columbia, present several novel geological features. In places, very pure magnesium sulphate separates out and may be loaded directly. In other places, both magnesium and sodium sulphate occur in various proportions. The series of deposits cousist of calcium carbonate, hydrated magnesium carbonate, gypsum and epsomite. They all occur in very fine grains; the epsomite is the only product being worked so far. The lake deposits consist of numerous circular closely spaced areas of magnesium sulphate, overlain by a few inches of brine, and between them there is a dark mud mixed with the salt. The under surface appears convex, or cone-shaped. All these deposits offer a striking exercise for the application of physico-chemical principles to the solution of their cause. Freight rates and the fact that the pharmaceutical trade is accustomed to larger crystals is delaying the wide sale of these products, but eventually they must command the Western market.

UNITED STATES.

Future of the National Research Council.—The National Academy of Sciences having been requested to perpetuate the National Research Council has adopted a plan for a permanent foundation to replace the temporary war-time organisation. The purpose of the Council is to promote research in the mathematical, physical and biological sciences and in the application of these sciences to the useful arts such as engineering, agriculture and medicine. In order that the work may be carried on most effectively the Council is being organised in divisions of which there are two classes:—(A) Those dealing with the more general relations and activities of the Council, and (B) divisions concerned with related branches of science and technology. Under this classification the divisions under (A) are I. Government, II. Foreign Relations, III. State Relations, IV. Educational Relations, V. Industrial Relations, and VI. Research Information Service. Under (B) the divisions are those of VII. Physical Sciences, VIII. Engineering, IX. Chemistry and Chemical Technology, X. Geology and Geography, XI. Medical Sciences, XII. Biology and Agriculture, and XIII. Anthropology and Psychology. The organisation is being rapidly completed along these lines and the work is proceeding in accordance with the policies adopted. A number of National Research Fellowships have already been granted for chemistry and physics.

The Essential Oil Industry and the Projected Ban on Alcohol.—The prospect of being deprived of alcohol in the near future has caused some concern among manufacturers of flavouring extracts, especially as some States have already prohibited the sale of certain flavours which usually contain high percentages of it. Since the use of any solvent not known to have food value and to be readily assimilated by the human body may be barred in future, the possibilities are somewhat limited. Bakers have found purified and refined vegetable oils, such as coconut and cottonseed oils, satisfactory diluents for lemon, orange and such oils, and recent research indicates the possibility of using glycerin in one form or another for vanilla. This may, however, necessitate some revision in standards, since certain resins dissolved by alcohol are not soluble in glycerin or its derivatives, and hitherto the presence of such resins has been required in a true vanilla bean extract as distinguished from synthetic vanillin. The glycerin extract appears to be perfectly satisfactory in appearance and in use. The perfumers seem to be faced with a more difficult problem since the more delicate perfumes may be easily overcome or neutralised by the odour of the substitute solvent. The use of small drops of the undiluted extracts may come into vogue.

Benzyl Alcohol as Local Anæsthetic.—Benzyl alcohol is now available for use as a local anæsthetic. It is said to be very efficient, a 1 per cent. solution producing anæsthesia for 30 minutes.

Cost of Production of Nitric Acid.—In a paper read before the American Chemical Society on May 8, Dr. C. L. Parsons compared the cost of production of nitric acid from Chilean nitrate with that of acid made by the catalytic oxidation of ammonia. He stated that a 94 per cent. acid could be made by the latter process, in competition with acid from Chilean nitrate when this material cost 2 cents per lb. and the cost of ammonia was 11½ cts. per lb. The cost of 50 per cent. acid would be the same by the two processes when nitrate cost 2 cts. per lb. and ammonia 14 cts. per lb.—(*Chem. and Met. Eng., May* 15, 1919.)

Progress in Electro-Chemistry.—In his presidential address to the American Electro-Chemical Society on "Electro-Chemistry and its Human Relations," Mr. F. J. Tone dealt with recent applications of electro-chemistry to agriculture, sanitation and metallurgy. Referring to the use of chlorine for sterilising potable water, he stated that more than 20 millions of the population of the United States dwelling in cities are now safeguarded from disease by this means. During the recent influenza epidemic the number of cases in the cell rooms of two electrolytic chlorine plants, located in different States, was one-half of that in any other portion of the plants. The Carrel-Dakin solution for the treatment of wounds is perhaps the greatest surgical discovery of the war. A large field lies open for the use of chlorine in sterilising sewage. A million gallons of the latter can be sterilised with 120 lb. of hypochlorite, and the cost of treating the sewage of a city of 1 million inhabitants does not exceed $360 a day, or about 6*d*. per head per year. Chlorine should also be applied to the sanitary control of milk supply.

The electric furnace is used in the third stage of the triplex process for refining steel, whereby a product is obtained from which rails are made which do not break and plates which do not fracture. It is the task of the electro-chemist to produce alloy steels in such quantities that not only the vital parts of motor cars, farm tractor motors and aeroplane engines can be made of them, but the entire mechanisms. We seem to be on the eve of great advances in the manufacture and use of

ferro-uranium and ferro-zirconium; in fact, it is whispered that a zirconium-steel can be made of tensile strength 300,000 lb., with 30 per cent. elongation. The use of such material for the construction of ocean liners and railway trains would increase their carrying capacity by 25 per cent., or, with the same weight of metal, they could be made four times as strong. In a word, the task of the electro-metallurgist is to put super-steel on a big tonnage basis.—(*Chem. and Met. Eng., April* 15, 1919.)

JAPAN.

The Iron and Steel Problem.—The Tokio Chamber of Commerce proposes that relief be secured for the iron and steel industry by raising the Customs duty and by granting subsidies. The suggested increase of rate on pig-iron is from 10 sen (2½*d.*) to 50 sen (1*s.*) per 100 kin (133⅓ lb.), the latter figure being equivalent to an *ad valorem* duty of 21·5 per cent. It is further suggested that a subsidy be granted on pig-iron produced by Japanese firms in Manchuria, China, and Korea, sufficient to counterbalance the import duty. Shipbuilders oppose these tariff proposals. As late as last March the agitation for Government assistance of the iron and steel trades continued unsuccessfully, and a proposed combine of these trades remained uneffected. English pig-iron is on offer at a price considerably below the cost of production in Japan.—(*Bd. of Trade J., May* 29, 1919.)

GENERAL.

"The Chemical Age."—We are pleased to extend a welcome to this new weekly contemporary, of which the first issue appeared on June 21. The sphere of activity of the new journal will be the fertile field of industrial chemistry, and, as may be gathered from a perusal of the first number, the interests of engineering chemistry will receive particular attention. The publishers are Messrs. Benn Brothers, Ltd., of 8, Bouverie Street, E.C., who are the proprietors of the *Gas World* and other publications.

Report of the Alien Property Custodian of the United States. The Association of British Chemical Manufacturers has had this report reprinted from, and by permission of, the *Journal of Industrial and Engineering Chemistry* (see this J., 1919, 197 R). Those who wish to obtain a copy may do so by applying to the Secretary of the Association, at 166, Piccadilly, London, W. 1, enclosing a postal order for 1*s.*

The Cane Sugar Industry in Cuba.—The sugar cane is said to have been introduced into Cuba in the year 1523. The climate is unsurpassed for the growth of abundant cane crops, and as, moreover, the soil is very fertile, little artificial manuring is done. A series of successful experiments with sulphate of potash, superphosphate and slaked lime has, however, proved the importance of their application. The plants are reproduced by cuttings, take 18 months to ripen, and are not infrequently grown for 25 years in the same field, during which period the yield gradually diminishes. The density and purity of the juices, however, increase. Fifty tons of cane per acre are often obtained. Cuba was a Spanish colony from 1492 to 1898, when it became an independent state under American suzerainty. To the abolition of Spanish rule and the subsequent introduction by the United States of the latest machinery and the most up-to-date scientific methods of culture and extraction, the marvellous growth of the Cuban cane industry must be ascribed. The annual production of 70,000 tons in 1817 had in 1850 advanced to 300,000 tons. In 1894, 1,054,000 tons represented the maximum production under Spanish rule, and the minimum production of 212,000 tons occurred in 1896, when war and rebellion raged throughout the island. When peace had been re-established the industry made a wonderful and steady recovery, producing 300,000 tons in 1900, 1,163,000 tons in 1905, 1,180,400 tons in 1910, and 2,593,000 tons or 14·14 per cent. of the total world's production in 1915. In 1918, Cuba furnished 19½ per cent. of the world's sugar production, or 3,350,000 tons, and for 1919 Willet and Gray estimate a probable crop of 3,600,000 tons. During the war Cuba has supplied a portion of the deficiencies caused by the failure of the European beet sugar crop, which dropped from 8,758,900 tons in 1914 to 5,050,000 tons in 1918.

Sugar Crop of the West Indies in 1918.—Last year's weather conditions in the West Indies were not favourable to sugar production. The sugar and molasses, in terms of sugar, exported both in 1916 and in 1917 amounted to 300,000 tons; last year the quantity was 50,000 tons less; prospects for 1919 are better, the total estimate being 291,225 tons. The exports of sugar and molasses in 1918 were:—Dark crystals 21,478 tons, Canada taking 79 per cent.; yellow crystals 240 tons (Newfoundland, 75 per cent.); white crystals 290 tons (Newfoundland, 55 per cent.); muscovado 11,190 tons (Great Britain, 76 per cent.); fancy molasses 9,113,614 galls. (Canada, 62 per cent.); choice molasses 1,283,268 galls. (Newfoundland, 67 per cent.); vacuum pan molasses 286,727 galls. (Great Britain, 99 per cent.).—(*U.S. Com. Rep., April* 18, 1919.)

Fermentation Glycerin.—In connexion with the production of glycerin by the alcoholic fermentation of sugar, a paper was recently read by K. Schweitzer before the Swiss Chemical Society on the effect of adding a reducing agent to the fermenting liquor. According to Oppenheimer, the glycerin is formed by reduction of glyceraldehyde or dihydroxyacetone, into which the hexoses are primarily broken up. The author found that acid reducing agents were unsuitable, but sodium sulphite produced a greatly augmented yield. Whereas Pasteur (1857) obtained from 100 grs. of sugar with yeast 3·6 grm. of glycerin, and Oppenheimer (1914) with yeast juice got 3—12 grm., Schweitzer with yeast and sodium sulphite obtained 21·3 grm. The yield obtained by Eoff, Linder and Beyer (this J., 1919, 175 R) using a yeast and sodium carbonate was 20—25 per cent.—(*Schweiz. Chem.-Zeit.*, 18—19, 1919.)

German Industry and the Peace Negotiations.—The "Reichsverband der deutschen Industrie" (Imperial Association of German Industries) has declared that the acceptance of the proposed terms of peace would be a death-blow to the economic life of Germany. The territories demanded by the Allies are indispensable for the supply of agricultural produce and raw materials, especially coal and ores; and the fulfilment of the condition that a considerable portion of the remaining coal supply shall be delivered to France, Belgium, Italy and Luxemburg would lead to industrial paralysis. The production of iron would be reduced to one-fourth; and the obligation to give the Associated Powers the benefits of the most-favoured-nation clauses without reciprocity would lead to the flooding of German markets with foreign goods. The power given to the Entente to determine the quantities of raw materials and foodstuffs to be imported into Germany shows a brutal will to destroy by causing unemployment and ruin to millions of German working-class families. The surrender of the merchant fleet and the enslaving of the shipbuilding yards to work for the Allies exposes Germany entirely to the arbitrary power of her competitors. The acceptance of the peace conditions would be worse, from an economic standpoint, than the continuation of the blockade

and the occupation of the coal districts. The Reichsverband therefore affirms that the proposed peace conditions are impossible to execute and therefore unacceptable.—(*Stahl u. Eisen, June* 5, 1919.)

Blast Furnaces in Belgium.—According to the *Moniteur des Intérêts Matériels,* the number of blast furnaces in Belgium on July 1, 1914, was 60, of which 49, having a total output capacity of 7057 metric tons per 24 hr.-day, were then in blast. The actual output for the first half of 1914 was 1,233,410 tons. To-day the output is *nil.* With the exception of four furnaces in Hainaut, which had been requisitioned and are in good condition, practically every furnace has been wholly or partly demolished. Before the war Belgium possessed 50 converters, 19 open-hearth furnaces and 96 rolling mills.—(*The Iron Age, May* 21, 1919.)

Condition of the Belgian Glass Industry.—All Belgian window-glass factories remain intact, raw materials are in hand, and labour available, but it will take time to train young workmen to make up for the deficiency caused by the war. The factories are not yet running, however, owing to disagreement with trade unions regarding labour contracts. In 1914 there were 30 furnaces; at present there is one hand-worked and one machine-worked furnace in operation, and the production is 20,000 boxes of 100 sq. ft. per month. Glass is six and a-half times as costly as in 1914; the price of hand-made glass is now 260 francs per box of 300 sq. ft. loaded on car at factory, that of machine-made glass 240 francs per box, free sizes 4e. 21 ounces, 200 sq. ft. Belgium and France greatly need window glass; the French Government has made a proposal for 40,000,000 square metres at 225 francs per box of 300 sq. ft. A co-operative association comprising the principal Belgian window-glass manufacturers has just been formed with head offices at Charleroi. The capital is 224,750 francs divided into 8990 shares of 25 francs each. The plate-glass factories have not suffered very much, and although the Germans deported copper and machinery, most of the factories will be running again in a few months' time. Charleroi "rolled glass" sells at 12 francs (9*s*. 6*d*.) per sq. metre. Most of the crystal-glass factories have continued to manufacture half-crystal glass during the war, but labour trouble exists at present. The only Belgian bottle factory—at Jumet—has continued to work during the war. A new factory to be worked on a French system is being built at Merxem near Antwerp. The furnaces will use tar fuel, which is giving good results in a glass factory in Holland.—(*U.S. Com. Rep., April* 12, *May* 12, 1919.)

Output of Alsatian Potash.—There are now five mines in operation, *viz.*, "Reichsland," "Theodor," "Max," "Marie," and "Luise," with a combined output of 2000 metric tons per day. It is hoped to double the production within about 3 months. In July next, "Amelia I and II," "Marie Josef," and "Else" will be ready to start operations, when the production should rise to 5000 tons. The "Prince Eugen" is expected to be ready by January 1920. "Anna I and II," "Ensisheim I and II," and "Rudolf" are expected to reach the producing stage in 1922, when the daily output should attain 9000 tons. All the mines are under French control.—(*Z. angew. Chem., May* 9, 1919.)

Reported New Oilfield in Western Mexico.—Recent investigations have revealed the existence of rich deposits of petroleum on the Pacific Coast. The Federal Government has conceded authority to explore and exploit an island (probably the island of Altamuro), which is stated to be extraordinarily rich in oil and in asphalt.—(*El Universal, March* 11. 1919.)

REPORTS.

Report on the Investigations carried out by the Chemical Waste Products Committee of the Munitions Inventions Department, Ministry of Munitions (*not printed*).

Considerations of economy and especially economy of freightage led to the formation in March 1918 of a special committee of the Munitions Inventions Department to investigate the possible utilisation of chemical waste products. A long list of waste products was compiled after circularising manufacturers, and from this the Committee selected certain subjects for investigation. It was ascertained that about 30,000 tons of mimosa bark is treated annually in the tanning industry, and a process was evolved for the conversion into paper of the residue after the extraction of tanning material. In connexion with the utilisation of scrap timber for paper making, proposals for the erection of special plant were rejected because of the expenditure involved and attention was directed to the caustic soda treatment in esparto plants of pine, birch and oak, after the waste timber had been shredded into a suitable size at the saw mills.

A successful process was devised for detanning scrap chrome-tanned leather (which is not considered suitable for use as a fertiliser) and utilising it in the manufacture of glue. Many sulphuric acid manufacturers asked for information as to the best method of treating sulphide or arsenic residues; the treatment suggested was to raise the sludge to a temperature of 200° C. when the sulphide of arsenic and other impurities assume a granular form and can be separated from the acid, washed and dried for arsenic smelting.

The residues left after the extraction of alumina from bauxite have accumulated in large quantities, and although they contain a high percentage of iron they have not as yet been successfully utilised in this country. The German process for alumina extraction, roasting bauxite with sodium carbonate, converts the oxide of iron into a compound which ultimately yields ferric hydrate on treatment with water. Before the war this material was imported as "Lux" and largely used for purification of coal gas. The English caustic soda extraction process leaves the iron oxide in its original condition in the bauxite ore. Various processes for the conversion of these residues into material suitable for gas purification were examined, but none was found to give material to pass the rigid tests adopted by the Committee. Various other residues containing oxide of iron were examined and some found suitable for gas purification. A residue resulting from the manufacture of cyanide, and containing a high percentage of ferric hydrate, was rendered available by the introduction of a special drying process to give the right physical texture. Iron was recovered from the waste hydrochloric acid liquors obtained in the pickling of iron by the addition of lime in order to obtain material for gas purification.

In view of the importance of selenium in the glass industry various residues from sulphuric acid works burning pyrites were examined. The selenium found in flue dust was not worthy of consideration, while the amount present in the sulphate of lead sludge from the Glover tower and sulphuric acid chambers varied between 0·3 and 0·7 per cent. and in exceptional cases 4 per cent. was found.

The conditions for converting the residues left after the oxidation of organic substances by sodium bichromate and sulphuric acid were determined.

Crude benzol was recovered from the tarry residue from the sulphuric acid purification of benzol by treatment with steam or water to obtain a separation of acid of about 40 per cent. and subsequent

distillation of the tar with an equal weight of lime. Many residues consisting mainly of calcium sulphate were submitted to the Committee and examined for nitrogen with a view to their admixture with fertilisers.

Other matters dealt with were :—The extraction of chemicals used in P.H. gas helmets, the utilisation as a fertiliser of maize residues from the manufacture of butyl alcohol, the investigation of residues from the manufacture of acetic anhydride and of brucine, of residues containing sulphur, of the watery liquid from the steam drying of wood, of waste salt, of peat tar residues, and of hydrofluosilicic acid from phosphate works, the derusting of metals, the low temperature crystallisation of salts such as nitre cake, the production of methyl alcohol from methane, the treatment of nitrogenous liquors such as urine with magnesium phosphate, the corrosion of acid resisting metals, and the use of peroxide of manganese electrodes in the manufacture of persulphates.

The researches in progress are :—Further investigations upon bauxite residues, chrome liquors and sulphate of lead residues from acid works; the examination of quartz and mica residues from the preparation of china clay, waste liquors from the ammonia plants of Scotch blast furnaces, silicol residues from the manufacture of hydrogen and residues from alizarin manufacture, and the removal of copper and nickel from steel scrap bound with copper-nickel alloy.

The Committee recommends that its unfinished work should be carried to completion, and that the existing organisation should be developed as a permanent Chemical Research Department on lines similar to those of the National Physical Laboratory. The Department would consist of an advisory committee in association with a director and chemical staff with its own laboratories, and its duty would be to consider and report upon both problems from manufacturers and proposals from inventors.

Report on the Trade of Canada and Newfoundland, together with a detailed report on the Trade of the Province of Ontario for the year 1918. By F. W. Field, H.M. Trade Commissioner at Toronto. [Cmd. 163, 3*d*.] London: H.M. Stationery Office.

The following table, compiled by the Mines Department, Ottawa, contrasts the production of the principal metals in Canada during 1917 and 1918 (*cf.* this J., 1919, 164 R) :—

Products	1917	1918
Pig iron (short tons) ..	1,170,480	1,182,000
Steel ingots and castings (short tons)	1,745,734	1,910,000
Copper (lb.)	109,227,332	115,000,000
Zinc (lb.)	29,668,764	36,000,000
Gold (dollars)	15,272,992	14,750,000
Silver (oz.)	22,221,276	20,780,000
Nickel (lb.)	82,330,280	90,000,000
Lead (lb.)	32,576,281	—
Coal (short tons)	14,046,759	15,180,000
Total mining production of Canada (dollars) ..	189,646,821	220,000,000

There was an increased output of asbestos, chromite, felspar, graphite, magnesite, fluorspar, pyrites, etc., and also of petroleum.

The annual production of pulp and paper is of the value of about $100,000,000 a year, and the exports were valued at $71,754,425 for the year ending March 31, 1918. The total value of Canadian imports from the United Kingdom declined from $107,000,000 in 1917 to $81,000,000 in 1918. During the same period, imports from the United States increased from $664,000,000 to $792,000,000. While in the period 1915—1918, Canadian imports from the United Kingdom showed a decrease of 10 per cent. during the same period, the imports from the United States increased by 160 per cent. The two countries which made most headway in trade with Canada during 1918 were the United States and Japan. The proximity of Canada to the U.S.A. necessitates that the Canadian market should be given special consideration even amongst markets of the Empire. Suggestions are made as to how trade with the Dominion may be fostered. Special attention should be given to developing the various sale departments in the country. First-class representation by agents is essential, and connexions should not be severed during periods of trade depression. The questions of the despatch of goods on consignment, invoices, etc., need attention. Designs peculiar to Canada must be adopted by British manufacturers, and the scale of advertising expenditure needs thorough revision. Loose-leaf catalogues and the cinema are means of advertisement to which special attention is drawn. Personal visits of the firms' representatives to Ontario are recommended. A reciprocal interchange of Canadian and British graduates in engineering is desirable in order to standardise current engineering practice in the two countries.

The mineral production of Ontario is about half that of the whole of Canada. It has increased in value from $6,000,000 in 1893 to $72,000,000 in 1917. The Copper Cliff and Coniston smelters during 1918 treated 1,141,089 tons of ore, producing 64,926 tons of matte containing 33,688 tons of nickel and 17,232 tons of copper. The International Nickel Co. commenced operations in July, and between July and September produced 358,205 lb. of nickel and 359,713 lb. of copper from nickel-copper matte.

The United States has established over 500 branch works or assembling plants in Canada, representing an investment up to October 1916 of $251,000,000, a decided impetus towards development in this direction having been evident in 1918. It is suggested that United Kingdom firms should consider the advisability of following this tendency.

Although an important linen industry has just been established in Ontario, importers contemplate a continuation of an excellent import trade in this material with Britain. In the matter of chemicals, there has just been considerable development in the production of glycerin, ethyl alcohol, toluol, benzol, methylethylketone, butyl alcohol, crude magnesite, calcined ferruginous magnesite, chrome, china clay, ochre, Epsom salts and alums. Sal-ammoniac is being manufactured for the first time, likewise aspirin, phenacetin, permanganate of potash, paramidophenol base and hydrochloride. Dyes are obtained principally from the United States. The domestic export trades in paints and varnishes are being extended. The dry colours employed are largely of domestic origin. There has been considerable progress in the manufacture of illuminating glassware. The opinion is general that the United Kingdom will regain its trade with Ontario in chinaware lost during the war, and now largely held by Japan.

Reports from Trade Correspondents in Nova Scotia, New Brunswick, Quebec, Manitoba, Saskatchewan, Victoria, Vancouver, and Newfoundland are also included. The minerals and mineral products of Nova Scotia were valued at $55,840,000 in 1918, and $50,109,000 in 1917. The gold bearing lands have an area of 3000 sq. miles. The present annual coal production is 6,000,000 tons. The annual output of gypsum is about 300,000 tons, and is exported largely to the United States, whence it is returned in the form of manufactured articles. The coal production of New Brunswick in 1918 totalled 265,000 short tons. The antimony deposits

are to be developed, and it is anticipated that the mines will be in operation early in 1919. The oil production amounted to 2800 barrels during the year. The iron mines in Newfoundland produced and exported over 800,000 tons in 1918. Appendices are devoted to statistics of the paper and pulp industry of Ontario 1917, and a comparison of the imports into Canada for consumption of dutiable and free goods for the fiscal years ending March 31, 1914 and 1918.

[Additional matter contained in the Report has been recorded in previous issues of this Journal (*cf.* Review, 1919, pp. 7, 25, 51, 63, 85, 105, 125, 143, 165).]

COMPANY NEWS.

BROKEN HILL PROPRIETARY CO., LTD.

The 39th ordinary general meeting was held in London on June 12, Mr. J. S. Smith-Winby presiding. After protesting against the injustice of being subject to double income-tax, and of the postponement by the Government of the settlement of this question by referring it to a Royal Commission, the Chairman reviewed the position of silver and lead. The situation of and the outlook for silver were satisfactory, particularly from the producers' point of view, but the lead position was serious. The action of the Government in raising the price of lead from £29 on November 11, 1918, to £40 per ton on November 26, at a time when there were large stocks on hand, resulted in increased production and in shaking the confidence of consumers. The price has since fallen to below £23, a level which at the present time renders production quite unprofitable in many countries. No complaint could be urged against the Government for not continuing the contract with the Broken Hill Associated Smelters Co. after March 31 last. This company is the largest exporter of lead in the world, having a yearly plant capacity of over 200,000 tons of lead for export, a quantity more than sufficient to supply the annual requirements of the United Kingdom.

The reserves of the Proprietary Co. were estimated in December last at 1,095,015 tons of ore of an average assay value of 6·7 oz. silver, 12·8 per cent. lead and 11·6 per cent. zinc. There is still a considerable quantity of carbonate ore in the mine. Mine expenses are increasing rapidly; the costs for ore-raising and for lead and zinc mill treatment before the war averaged 25*s.* 3*d.* per ton over three years; last year they were 34*s.* 3*d.* per ton. Prices of mining requisites are exceedingly high, and the demands of labour are insatiable. Considerable trouble has been experienced with labour, many of the miners being misled by professional agitators; at the present time all the principal mines are shut down as the result of a dispute between certain of the Labour Unions. The profit on last year's working, after providing for administration and depreciation, was £214,166 (capital £600,000), which was £80,000 in excess of the previous year.

BRITISH DYESTUFFS CORPORATION, LTD.

At an extraordinary general meeting held at Manchester on June 17, resolutions were unanimously agreed to authorising increases of capital from the original £6,000,000 to £8,000,000 by the creation of 2,000,000 additional preferred ordinary shares of £1 each, and to £10,000,000 by the creation of 2,000,000 additional preference shares of £1 each.

BRUNNER, MOND & CO., LTD.

In presiding at the annual meeting held in Liverpool on June 20, Mr. Roscoe Brunner stated that the issued capital of the company had been increased by £212,000 to purchase nearly the whole of the shares of the Buxton Lime Firms Co., Ltd. Profits had decreased by £99,000, and the dividend on the ordinary shares had accordingly been reduced from 11 to 10 per cent. It is now proposed to increase the nominal capital of the company from £10,000,000 to £15,000,000.

Dealing with the manufacture of high explosives, Mr. Brunner said that most of the TNT originally produced in this country, and also that sent from America and Canada, had been far too impure to be used with safety. The method of purification adopted was invented in the company's laboratories. The process of manufacturing synthetic phenol was so improved by the staff that the company was able to obtain the highest yield in the country. The second largest works, Lostock, was given up to the production of ammonium nitrate, at the sacrifice of a large output of soda ash. This substance was made by three different processes, the first comparatively simple, but the other two presented difficulties which at first appeared to be insoluble. Many new plants were erected, factories were built and old ones adapted; in all, there were nine different plants under the company's control from which more than 5000 tons a week of high explosive material was turned out; in addition plans were supplied for the construction of an ammonium nitrate factory in America with an output capacity of 4000 tons a week. The initial contracts with the Government were undertaken at 5 per cent. profit above cost, but as there had been no desire to make large sums out of war work, this was altered, at the company's suggestion, to a basis of fixed prices per ton of products supplied, thereby reducing the profits considerably. Trade is now apparently beginning to revive—a change which would have come earlier but for the ever-growing demands of labour. During the war, Government factories may have produced on as favourable terms as private works, but the point was debateable; and it must not be overlooked that during that period the State relied much upon the assistance rendered—often gratuitously—by many eminent technical men, which it would not have in time of peace. With regard to coal, the Controller had reckoned on a saving of 700,000,000 ton miles per annum by taking the whole of the distribution into his own hands. The result had not been published, but in the case of Brunner Mond and Co., calculation had shown that his intervention had led to a loss of more than 2,000,000 ton miles per annum.

The report and accounts were adopted and the proposed increase of capital carried unanimously.

BRITISH CYANIDES CO., LTD.

On June 20 the annual general meeting was held in London, Mr. C. F. Rowsell, chairman of the company, presiding. In moving the adoption of the report and accounts, Mr. Rowsell stated that the trading profit for the past year was £62,720, and the net profit, subject to excess profits duty (if any), £20,572, the corresponding figures for the previous year being £67,478 and £36,725, respectively. The decline in profits was more than accounted for by the sudden cessation of the manufacture of an important chemical compound for the Government when the armistice was signed. The issued capital now stands at £278,558, and the reserve account at £23,000. The past year had been a very difficult one, but the future is regarded hopefully, the demand for the company's products being now

again on the increase. With reference to the British Potash Co., negotiations are on foot which, when completed, will secure to the company large supplies of raw material, and place the large-scale production of muriate of potash on a competitive basis.

Mr. Kenneth M. Chance, managing director, referred to the shortage of cyanide in the first year of the war, and described how the company by doubling its output had helped to alleviate the situation. After much preparatory work, which had involved the erection and pulling down of three large-scale plants within three months, it had been able to meet the full requirements of the country for carbonate of potash for optical-glass. The best quality of this substance could only be manufactured from native raw material. Very large quantities of sodium permanganate had been produced for use in gas-masks. In general, the output of the company had increased greatly during the war; the number of articles manufactured increased from two to nine, the weight by $2\frac{1}{2}$ times and the value by $5\frac{1}{2}$ times. Mainly owing to want of confidence, the chemical trade of the country was doing badly at the moment, but he predicted a remarkable period of prosperity as soon as the tide turned. The company would be in a good position to meet demands owing to its large expenditure on new works, shortly to be completed. Amongst other activities, experimental work on a nitrogen fixation process is to be resumed in August next.

THE MOND NICKEL CO., LTD.

Mr. Robert Mond, chairman of the company, has intimated that owing to stagnation of trade and consequent accumulation of stocks, the directors of the company have with great regret been compelled to close down three-quarters of the works. It is hoped, however, that the situation will rapidly improve after the conclusion of peace, and that normal production will then be resumed. Meantime the suspension of work involves the temporary dismissal of a large number of workpeople, but in the matter of employment preferential treatment is being accorded to returned soldiers and others who have done work of immediate national importance.

MAYPOLE DAIRY COMPANY, LTD.

The profits of this company for 1918 amounted to £713,566, compared with £747,249 in the previous year. Since the partial lifting of the blockade there has been a great advance in the price of raw materials owing to competition from countries short of food. Hence there has been a considerable rise in the cost price of margarine. The capital of the company has been increased to £3,000,000 by the creation of 16,000,000 new shares (deferred ordinary) of 2*s.* each, which will be issued at par to holders of the old deferred ordinary shares as and when required.

New Registrations.—*The British Empire Sugar Research Association* has been registered as a company limited by guarantee to promote, assist and conduct research and other work for the furtherance of the sugar trade or industry. Membership is restricted to British subjects or corporations.

Radiation, Ltd., has been registered to effect a combination of the interests of John Wright and Eagle Range, Ltd., the Richmond Gas Stove and Meter Co., Ltd., and the Davis Gas Stove Co., Ltd. The nominal capital of the new company is £2,750,000.

OFFICIAL TRADE INTELLIGENCE.

(*From the Board of Trade Journal for June* 12 *and* 19.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 73, Basinghall Street, London. E.C. 2, from firms, agents, or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons referred to by applying to the Department and quoting the specific reference number.

Locality of Firm or Agent.	Materials.	Reference Number.
British India ...	Dyes	1166
British W. Indies	Paints, oils, varnish ...	1167
Canada	Chemicals for rubber and paint trades, quinine, magnesium carbonate	1128
"	Chemicals, dyes, textiles	1129
New Zealand ...	Chemicals, fertilisers ...	1131
" ...	Heavy chemicals ...	1170
South Africa ..	Glycerin for manufacturing purposes	1171
Belgium ...	Chemicals for glass and pottery trades ...	1136
" ...	Chemicals, dyes ...	1138
" ...	Dyes, varnish	1139
" ...	Oils, spirit	1141
" ...	Perfumes, foodstuffs ...	1145
" ...	Asbestos	1148
" ...	Glass, soap, varnish, paint	1149
" ...	Margarine	1153
" ...	Ultramarine, soap ...	1154
"	Iron, steel, bronze, fire-bricks, chemicals ...	1175
" ...	Chemical and pharmaceutical products, drugs, rubber	1182
" ..	Steel, cast steel, high speed steel, forged steel	1187
" ...	Tinplate, colours, paint, varnish, caustic soda, potassium, dyes ...	(3336 T&R)*
Greece ..	Paint, fertilisers, glass, perfumes, pharmaceu- products	1188
Italy	Chemicals, copper sulphate, soap	1159
Rumania ..	Tinplate, chemicals, copper sulphate, caustic soda	1190
Spain	Ammonium sulphate, sodium nitrate ...	1194
"	Celluloid, colours, paints	1163
"	Tanning materials, indigo, cochineal, quinine, metallic filaments ...	1195
" ..	Chemicals, dyes, drugs, perfumes, paint, varnish	1197
Morocco ..	Candles, soap, druggists' requisites	1200
Brazil	Asbestos, paints, chemicals, drugs	1202

* Belgian Section, Department of Overseas Trade, India House, Kingsway, W.C. 2.

TARIFF. CUSTOMS. EXCISE.

Australia.—The importation of all rubber-covered wire is prohibited as from July 1 unless labelled in accordance with certain specified conditions.

Canada.—The importation of cocaine, opium, opium alkaloids, their salts and derivatives is prohibited, except under licence, as from May 14.

The prohibition of the export of Canadian silver coin, bullion and bars has been cancelled as from May 14.

France and Algeria.—The *ad valorem* surtax on imported goods has been increased as from June 14. The rates vary from 10 to 40 per cent. for the "General" Tariff and from 5 to 20 per cent. for the "Minimum" Tariff.

The existing prohibitions on imports have been removed except in some cases which include coal tar products, dyes and perfumes, as from June 20.

French West Africa.—An internal consumption tax of 5 francs per 100 kilo. has been imposed, as from February 28, on salt of any origin whether marine, saline, crystalline or table salt, and whether imported into or produced within the Colonies of French West Africa.

Netherlands.—The prohibition of the export of cork has been cancelled as from May 21.

New Zealand.—The import of goods from Belgium finally manufactured in that country is allowed under certain conditions.

Nigeria.—An additional export duty of £2 per ton has been levied on palm kernels. It will come into operation on a date to be fixed by the Governor and will remain in force for 5 years.

Rumania.—Most of the existing restrictions on the import of goods have been removed as from May 15. Exporters should note that it is necessary for all invoices to be viséd at the Rumanian Legation in London and that firms must produce a certificate from a British Chamber of Commerce certifying that the goods are of British origin and that the prices set forth in the invoice are the current prices ruling in the U.K.

Salvador.—As from July 1, the rates of customs duty on petroleum and gasoline will be 5 centavos (gold) per kilo. in each case.

United States.—On and after July 1, nitrate of soda and potash may be imported without restriction under a General Import Licence when coming from countries with which general trade is authorised.

GOVERNMENT ORDERS AND NOTICES.

EXPORTS.

The Board of Trade has announced the following further relaxations of existing export prohibitions:—

Headings transferred from one list to another.

From List A to List C:—

Copper sulphate.—(June 12.)

From List B to List C:—

Malt sugar and articles and preparations containing; coal tar pitch.—(June 12.)

Potash salts and mixtures containing such salts not otherwise prohibited.—(June 19.)

Altered headings.

(A) Aircraft, other than balloons, of all kinds and their component parts, together with accessories and articles suitable for use in connexion with aircraft; quinine sulphate. (C) Cinchona bark, its alkaloids and salts, and preparations of any of these substances, except quinine sulphate.

Exports without licence.—As a result of the removal from List A of preparations containing quinine, except quinine sulphate, the heading on the free list of exports relating to patent and proprietary medicines has been amended to read as follows:—"Medicines, proprietary and patent, except such as contain cocaine, santonin, cod liver oil, opium or opium alkaloids."

Exports of foodstuffs.—An open general licence has been issued permitting the export to unoccupied Germany, Finland, Esthonia, Poland, Lettland (Latavia) and Lithuania, of all foodstuffs except those included in Section A or B of the prohibited list.

Exports to Sweden and Denmark.—Except for goods on Lists A or B, all restrictions on export to these countries, whether by freight or by parcel post, have been removed.

IMPORTS.

General licences have been issued permitting the importation of upper leather and fibre flax seed for sowing.

Certificates of origin and interest are no longer required for goods imported into the United Kingdom from Belgian ports.

Importation of dyestuffs.—The following announcement was issued by the Board of Trade on June 19:—

Whilst the regulation of the import of dyestuffs was primarily necessitated in order to prevent the free access of German materials to this market, it was felt that some measure of control was desirable over all imports if the scheme was to be thoroughly effective. It was therefore decided that a Central Importing Agency should be established under the direct control of the Committee through which all imports of dyestuffs must pass at some stage. As soon as the Committee is in a position to consider applications for the import of German dyestuffs, which will not be until after the withdrawal of the Trading with the Enemy Regulations, the Central Importing Agency will be the medium through which supplies are made available to consumers. Except in the case of German dyes, the agency will now undertake if desired the purchase of dyestuffs abroad on behalf of consumers, but where it is desired to make purchases direct or through recognised merchants the goods will merely require to be consigned to the agency for the account of the particular consignee and the shipping documents made out accordingly. For its services the agency will charge a commission of 1% on the invoice value of the goods with a minimum charge of 5*s.*, but this charge will not include any incidental expenses such as freight insurance, storage, etc., which must naturally be additional and borne by the importer. The offices of the Central Importing Agency for the time being are at 21, Spring Gardens, Manchester. Any firm desiring further information on the subject or wishing to make application for an import licence are advised to communicate direct with the Secretary of the Licensing Sub-Committee at 53, Spring Gardens, Manchester.

TRADE NOTES.

BRITISH.

Sierra Leone in 1917.—The exports of palm kernels during the year 1917 increased by 12,704 tons and in value by £161,803 over those of 1916. The United Kingdom imported 97½% of the total exports of 58,020 tons. The Imperial Government fixed the price of palm kernels in May, 1917, at £26 per ton, but it was found necessary by shippers to lower the price paid to native producers, and this has had an adverse effect on the quantity brought to market. The exports of palm oil, amounting to 543,183 gallons, show a decrease of 2·6%. This is due to the increased consumption for the manufacture of native soap owing to the high cost of the imported article. Of the total quantity exported, 97% went to the United Kingdom. Only 471 tons of piassava was exported, as against 883 tons in 1916, although prices have risen from £44 per ton to £78 per ton. The number of hides exported amounted to 9167, as compared with 14,989 in 1916. The prohibition of the importation of hides into the United Kingdom naturally interfered with this trade. A promising industry in cocoa is being built up in the North Sherbro District. Practically all the cocoa is, however, sold in an unfermented state. A Government Cocoa Station has been established to afford assistance and advice. The groundnut crop suffered severely

from the heavy rains. Over 700 acres have now been planted with gum copal and the plants show great promise.—(*Col. Rep. Ann., No.* 990, *May*, 1919.)

FOREIGN.

Japanese Copper for Germany.—The Japanese Department of Commerce has given its consent to the resumption of the export of copper to Germany. The deliveries will afford immediate relief to the Rhenish-Westphalian and the Upper-Silesian industries; at the moment there is no shipping available.—(*Z. angew. Chem., Mar.* 28, 1919.)

Sulphuric Acid Prices in Germany.—The following new maximum prices for sulphuric acid and oleum were fixed by Government Order on April 24, 1919:—(*a*) Sulphuric acid, up to 78% monohydrate, 510 marks per metric ton. (*b*) Acid, 78 to 92% monohydrate, 1000 marks per ton. (*c*) Highly concentrated acid, over 92% monohydrate, and oleum up to 40% free anhydride, 684 marks per ton. (*d*) For acid for special purposes, *e.g.*, chemically pure acid and acid used for accumulators, the maximum prices will be as above plus an addition proportionate to the cost of production. The above prices are f.o.r. ex-works.—(*Z. angew. Chem., May* 9, 1919.)

Allocation of Potash Sales in Germany.—The Distribution Office for the Potash Industry has regulated the sales of potash during 1919 as follows:—

	Home sale.	Sale abroad.
	Double cwt. pure potash (K_2O)	
Carnallite, containing not less than 9% and not more than 12% K_2O...	39,000	–
Crude salts with 12—15% K_2O...	3,700,000	421,000
Fertiliser salts:		
20—22% K_2O	1,216,000	680,000
30—32% K_2O	49,000	6,600
40—42% K_2O (includ. fertiliser salt of 38% K_2O) ...	946,000	266,000
Chloride of potassium	3,015,000	56,500
Sulphate of potash—over 42% K_2O	72,200	230
Sulphate of potassium and magnesium	20,600	46,500
Totals ...	9,057,800	1,476,830
Grand Total	10,534,630	

—(*Z. angew. Chem., May* 6, 1919.)

Dutch Guiana in 1917.—This colony suffered severely from war conditions during 1917. The production of cacao amounted to 2,243,595 kilo., an increase of 20% over 1916, yet the total crop realised 8% less than in the latter year. The production of sugar for the year was 11,210,209 kilo., and of molasses 530,375 litres. Rubber production decreased about 50% and there seems little chance of increased production. The balata production amounted to 887,565 kilo. Much prospecting and development of the bauxite mines have taken place. Sisal hemp was exported for the first time to the extent of 2225 kilo. The imports included cement valued at £2350; paint and varnishes valued at £7300; and soaps valued at £10,000.—(*U.S. Com. Rep. Supp., Mar.* 13, 1919.)

The Swiss Chemical Industry.—Since the year 1917 when the Swiss chemical industry reached its greatest prosperity the activity of foreign competitors has become increasingly perceptible and the cost of raw materials and of coal, now about eight times its pre-war prices, causes some anxiety. Competition in the dye trade is mostly to be feared from England.

Extensive developments similar to those in the manufacture of sulphuric acid and dyes (this J., 1919, 113 R) have occurred in other chemical industries, such as the production of pharmaceutical substances, the prices of which have fluctuated more widely than those of dyestuffs and now tend downward, and the manufacture of soda, the whole Swiss demand for which formerly supplied by Germany can now be met by the Schweizerische Sodafabrik. Regular supplies of foreign phosphates are still required, but a mixed fertiliser composed of basic slag and potash from Germany and of calcium cyanamide produced in Switzerland, has been found useful.

The electro-chemical and electro-metallurgical industries, although independent of coal, have experienced the prevailing difficulties in obtaining raw materials, but nevertheless, contrary to anticipations at the beginning of the war when several factories ceased working in view of an expected failure of orders, their exports, and notwithstanding swollen costs, their profits, have increased greatly. The relatively small internal consumption of carbide has risen during the war from 3000 or 4000 metric tons yearly to about 15,000 tons; it is used for lighting and welding and for making calcium cyanamide, acetic acid and chlorine-containing solvents. The production of these and of alcohol, acetone and ammonia, for all of which there is a local demand, may grow, since several firms, faced with a withdrawal of foreign orders for ferro-silicon and similar alloys (the internal consumption of which is only about 1500 tons yearly) propose to turn their attention to the production of these substances. New uses for acetylene are as a substitute for motor spirit and for enriching illuminating gas from the distillation of wood. The cast steel produced in the electric furnace by two Swiss firms is approved by local machine-makers.

The following table gives the exports of the substances named during recent years, together with the percentage, to the chief importing countries:

EXPORTS.

Material	Year	Metric tons	Destination %
Pharmaceutical Products	1913	680	Germany, 29 U.K., 9 France, 9 Italy, 9
,, ..	1915	670	U.K., 21 Germany, 18 France, 16
,, ..	1917	800	Germany, 53 U.K., 10 France, 10
,, ..	1918 (9 months)	580	France, 21 Germany, 19 U.K., 16
Calcium Carbide ..	1913	31,800	Germany, 79
,, ..	1915	55,400	Germany, 88
,, ..	1917	59,500	Germany, 63 France, 29
,, ..	1918 (9 months)	57,800	Germany, 59 France, 39
Ferro-silicon ..	1913	16,200	Germany, 75
Ferro chromo &c. ..	1915	19,300	Germany, 96
,, ..	1917	22,800	Germany, 99
,, ..	1918 9 months)	12,200	Germany, 99
Aluminium . ..	1913	7400	Germany, 77
,, ...	1915	9100	Germany, 94
,, ...	1917	11,000	Germany, 97
,, ...	1918 (9 months)	7300	Germany, 97

("*Rückschau über Handel u. Industrie der Schweiz,*" *Schweiz. Bankverein; Schweiz. Chem.-Z.*, 16—17, 1919.)

REVIEWS.

Report on the Food Requirements of Man. *By the Food (War) Committee, Royal Society. Pp.* 19. *(London: Harrison and Sons.* 1919.) *Price* 1*s.* 6*d.*

Being the work of a Committee which is reputed to have influenced Government policy during the war, this Report is likely to be ranked as an authoritative document, but under so comprehensive a title a more meagre presentation of the problems of dietetics could not well be given. Nearly the whole of our food, we are told, is slowly burnt in the body, as it might be in a furnace: *therefore,* "the value of a food can be estimated by finding out how much heat it will produce when oxidised or burnt. If the total energy given off by a man in the course of a day is known, it is sufficient to give him a food yielding the same number of utilisable calories in order to cover entirely the requirements of the body. These are the net requirements."

Man, in fact, throughout the report, is treated as little more than a machine—to be stoked at intervals, like a steam engine boiler, with mere combustible matter.

The variations in the requirements, from this caloric point of view, according to age, size, work and environment, are considered at length—mainly with the object of pointing out how insufficient the data are and how difficult it is to appraise the values to be taken into account during the several periods of the day, particularly during work time. The most obvious method, it is argued, would be to define work by the number of kilogram-metres performed in the course of 8 hours. The essential factor, however, is not the mechanical value of the work done but the amount of energy which must be set free in the body—*i.e.* the amount of food or body substance which must be consumed in order to perform this amount of work; it is therefore necessary to know the output of energy in calories actually involved in every kind of occupation. Although the Committee has commenced a research on these lines, many thousands of observations must be made before it will be in a position to appraise correctly the energy requirements of the chief occupations. The greater part of the report is taken up by a discussion of the existing information on the subject, and is interesting reading. But would such data, if available, be of much practical value? Except under severe compulsion, such as war conditions involve, the masses are not likely to submit to academic limitations of the food supply: appetite and economic conditions are fairly certain to determine the public taste and demand. In the course of the account of his celebrated series of observations, dealing with the importance of accessory factors in normal dietaries, published in 1912, Gowland Hopkins makes the remark—

"Only those perhaps who have had the experience of feeding animals with excess of food and have noted the amount eaten for considerable periods, will realise how well adjusted, under normal circumstances, is the instinctive appetite to the physiological needs."

Taking into account the many personal and other factors that are operative, it is clear that a vast amount of labour would be spent to little purpose if an exhaustive experimental inquiry of the kind spoken of were carried into execution. We might almost equally well set to work to determine the amount of heat energy that should be expended "theoretically" in the various separate operations in the kitchen and in warming the house and allowance fuel accordingly—leaving out of account the fact that the heat usefully developed is a function of the stove and also of the operator, as well as of the fuel used.

The special requirements of children and adolescents are considered at considerable length but in somewhat naive terms, and the discussion does not carry us much, if at all, beyond the point at which we are left by ordinary common sense observation. Fortunately, it is recognised and insisted that the requirements of the young are high—at least equal to, if not greater than those of the adult, after childhood. Strangely enough, the schoolboy of the well-to-do classes is referred to as "well-fed and over-exercised"; over-exercised he may be, but as a rule he would scarcely describe himself as well fed at school; too often, it is to be feared, he is underfed, having regard both to the quality and variety of his food. Barlow's disease, an outcome of malnutrition, it is well known, was first met with in the homes of the rich.

The food requirements of brain workers form a separate section, but these again are considered mainly from the energy point of view—without taking into account the possibility that they may require an extra supply of reparative materials present in small proportions in many foods only; the use of a large proportion of protein food is recommended, but only on account of this being spontaneously oxidisable apart from the exercise of muscular activity.

The last chapter is devoted to the consideration of quality, under the headings of proteins, meat, carbohydrates, sugars, fats and accessory substances or "Vitamines." Although the accessory substances are referred to and stress is laid on their importance in the final section of this chapter, this is done in far too curt a way, only a third of a page out of nineteen being occupied by the discussion; taking into account how much has been learnt quite recently of their peculiar and essential value and of their limited distribution in foods in view particularly of the important contributions made by the English school to their study, it is surprising that so little is said on the subject. However inadequate our present knowledge of the science of nutrition may be, it is far from being so inadequate as the reader of the report might think. The Committee seems to have thought almost always in terms of calories; it may be suspected that the report was written only from this point of view, and that, in revising it, a wise editor inserted here and there a few lines which serve to give real guidance—such as the following for example:—

"*As a general rule one may say that the protein in the diet of the average man should not fall below* 70—80 *grammes* ($2\frac{1}{2}$ *to* 3 *ozs.*) *a day. The protein should be derived from a mixed diet and should include, if possible, a certain amount of protein of animal origin.* The special value of animal proteins and especially those of milk, for building up the body, is one of the reasons why milk is of such supreme value in the feeding of infants and young children, and *no diet for such can be considered satisfactory which does not contain a considerable proportion of milk.*" K

The Principles of Bleaching and Finishing of Cotton. *By* S. R. Trotman *and* E. L. Thorp. *Second Edition, Revised. Pp.* 347. *(London: C. Griffin and Co.* 1918.) *Price* 21*s. net.*

It is to be regretted that the authors, owing to circumstances arising out of the international situation, have not had the time to re-write this book for the second edition, because since the publication of the first edition quite considerable progress has been made on the scientific side of the industry treated. This new knowledge reduces the first two chapters on the structure and constitution of cotton to little more than history, and the matter on bleaching and bleaching powder would require considerable alteration.

The chapter on cotton testing might have included an account of the accurate testing machines used for determining the breaking strain and elasticity of yarns and papers, for it is only by using accurate instruments and making a large number of breakages that reliable information regarding strength can be obtained. The carbohydrates are discussed at length; the manufacture of starch is fully described although finishers do not make their own starch. The subject of alkali boiling is treated in a scientific manner. The authors make out a case for the caustic soda boil in place of the lime boil, sour, ash boil, but, perhaps, if their experience was of the Lancashire instead of the Nottingham trade, they would have different views.

Presumably this is the first book which has touched on the scientific side of finishing, for hitherto scientific development has little affected this industry. The descriptions of machinery are of great interest, and this book should be read by all bleachers interested in the scientific side of their occupation. S. H. HIGGINS.

COAL TAR DYES AND INTERMEDIATES. *By* E. DE BARRY BARNETT. *Pp. xvi + 213. (London: Baillière, Tindall, and Cox.* 1919.) *Price* 10*s.* 6*d. net.*

The introductory section of this handy treatise on coal tar dyes and intermediates contains a very readable historical summary which *inter alia* serves to lay stress on the value of work often underestimated as being purely academic. The author states that the full importance of the introduction of the first azo-colour was recognised only twelve years after this discovery, when "Griess and Kekulé had published their work on the constitution of the diazo- and azo-compounds." It is, moreover, interesting to note that for nine years after the discovery of Perkin's mauveine, "aniline colours had only been obtained by purely empirical methods" until the publication of Kekulé's benzene theory, which "at once placed the whole chemistry of the aromatic compounds on a scientific basis." In the reviewer's opinion these quotations contain a warning to which the exigencies of the present transition period are blinding many would-be educational reformers.

Attention is drawn to the defective and often purposely misleading nomenclature of colours. Alizarin yellow has no chemical relationship to alizarin, and azo-carmine is not an azo-dye. Unfortunately, however, there are cogent trade reasons for this irrational terminology.

The main portion of the book is divided into two parts, of which the first gives a summary of the preparation of intermediates, the primary reactions of nitration, sulphonation, chlorination and oxidation being discussed together with the secondary processes of amidation and hydroxylation. A useful introduction is given to the complex chemistry of the sulphonic acids of the naphthylamines, naphthols and aminonaphthols.

The second and larger part of the treatise is divided into fourteen sections, each giving an outline of the chemistry of a group of colouring matters. The large section on the important azo-dyes includes also a reference to the allied stilbene, pyrazolone and thiazole dyes. The sections on indigoid and anthraquinoid dyes contain an up-to-date synopsis of these complicated and valuable dyewares.

Each section is furnished with references to original memoirs and to patent literature. In view of recent developments among British dye producers, the author's experienced views on the future prospects of the synthetic colour industry in this country will be read with special interest.

The book shows signs of haste in proof reading, and contains several orthographical errors. The following are unconventional spellings of well-known chemicals:—pyrolousite, crysoidine, chrysaliine, istaine and alkaly. The names of Nevile and Winther are invariably given incorrectly. There is perhaps sufficient reason for distinguishing between the commercial products "benzol" and "toluol" and the chemical substances "benzene" and "toluene," but the necessity for a third set of synonyms "benzole" and "toluole" is not apparent. The Teutonic "oxy" is too frequently used as the equivalent for "hydroxy." The constitution of "J" acid has proved a pitfall. On page 62 is a bewildering account of the preparation of this important intermediate, rendered almost incomprehensible by an erroneous substitution of α- for β- positions in both the given recipes. A similar confusion is noticeable on page 109 in the graphic formulæ for the aldehydic and thiazole condensations of this acid.

Apart from these blemishes, which will probably be absent from the next edition, the treatise may be warmly recommended as a useful and practical introduction to the chemistry of synthetic intermediates and dyes. G. T. MORGAN.

SEASONING OF WOOD. *A treatise on the natural and artificial processes employed in the preparation of lumber for manufacture, with detailed explanations of its uses, characteristics, and properties. By* JOSEPH B. WAGNER. *Pp. xiii + 274, with 101 illustrations. (New York: D. Von Nostrand Company,* 1917.) *Price* 16*s. net.*

The great world-shortage of seasoned timber from which we are now suffering compels the universal adoption of artificial seasoning whenever possible, and it is with pleasurable anticipation that we turn to any work on the subject. That now before us is well printed and bound and has excellent plates, but so far as they illustrate seasoning their value is greatly depreciated through lack of adequate explanation in the text. Both the text and the glossary are marred by many gross mistakes and popular misconceptions. Statements such as the following appear frequently: "Resin in its hardened state as produced by heat is only slowly soluble in water and contains a large proportion of carbon, the most stable form of matter" (p. 158). "Where these means are applied which rely on heat alone to accomplish this purpose, only that of the moisture which is volatile succumbs, while the albumen (*sic*) and resin becoming hardened under the treatment, close up the pores of the wood" (p. 159).

With reference to the artificial seasoning of timber the sole parts worthy of note are taken in detail, without acknowledgment, from Tiemann's writings or U.S. Forestry Service Bulletins.

The book is nearly worthless to technologist and practical man alike, and is a great contrast to Tiemann's excellent work on the same subject.

G. STANLEY WALPOLE.

PUBLICATIONS RECEIVED.

THE ANALYSIS OF MINERALS AND ORES OF THE RARER ELEMENTS. *By* W. R. SCHOELLER *and* A. R. POWELL. *Pp. x+239. (London: Charles Griffin and Co., Ltd.* 1919.) *Price* 16*s.*

THE MANUFACTURE OF VARNISHES AND KINDRED INDUSTRIES. *Vol. I. The Crushing, Refining and Boiling of Linseed Oil and other Varnish Oils. Based on and including the "Drying Oils and Varnishes" of Ach. Livache. By* J. G. MCINTOSH. *Third edition, revised and enlarged. With 114 illustrations and numerous tables. Pp. viii+498. (London: Scott, Greenwood and Son.* 1919.) *Price* 17*s.* 6*d.*

CHEMICAL COMPENDIA IN THE ENGLISH LANGUAGE.

W. P. WYNNE.

The need for collating chemical data, arising from the accumulation of an ever-growing mass of material, was met in the first instance by the publication of dictionaries such as those identified with the names of Gmelin, of Watts and of Muir and Morley. Then, towards the close of last century, dictionaries gave place to compilations like Beilstein's "Handbuch der organischen Chemie" and Richter's "Lexikon der Kohlenstoff-Verbindungen," by reference to which it was possible for research workers quickly to identify, or to recognise as new, any compound which might be produced in the course of an investigation. Before the end of 1910, each of these publications had run through three editions and the preparation of a fourth edition of Beilstein's Handbuch was projected by the German Chemical Society. This fourth edition may reach 15 volumes, towards the cost of which subscriptions amounting to a total of 2,500,000 marks (£125,000) had been obtained by the end of June 1918, including contributions of 300,000 marks each from the large German chemical firms. In addition, a new publication, replacing Richter's Lexikon, was promoted by the same Society under the title "Literatur-Register der organischen Chemie," of which one volume, covering the period 1909-11, appeared in 1913, its production being subsidised by one of the German chemical firms.

Dependent on these German publications, chemists in the Allied and Associated countries have been handicapped since the outbreak of war by the fact that, outside of Germany, no organisation existed by which summaries of the organic chemical literature could be continued and brought up to date. This dependence on German compendia, moreover, had the effect of fostering the illusion that chemistry is a branch of science in which Germany especially excelled and of stimulating that flow of trained chemical students to German laboratories, which, by denuding non-German Universities of their most promising men, contributed to the German research output, while making research work difficult to organise in this and other countries for lack of workers.

Moved by these considerations, and with a full experience of the difficulty encountered in the many organic chemical industries, set on foot or expanded during the war, owing to the inaccessibility of German compendia, a strong committee was formed in Manchester towards the close of 1917, with Mr. F. W. Atack as secretary, to promote the compilation of chemical compendia in the English language. One important point in the case made by this committee was the necessity of restoring the prestige of the English-speaking nations in the domain of chemistry, and another was the need for an impartial survey of the literature both of inorganic and organic chemistry. German compendia, it is well known, are incomplete in regard to other than German literature, and in the new Literatur-Register (probably also in the new Beilstein) the references to non-German literature are made, without mention of authors' names, to abstracts of the original papers published in the "Zentralblatt," thus preventing reference to any other index or series of abstracts except through the medium of that German publication.

Early in last year, when the committee's proposals had received a sufficient body of support from the academic and industrial sides of chemistry, application was made to the Department of Scientific and Industrial Research for a grant in aid of the scheme. This application having been referred by the Department to the Council of the Chemical Society, the question of the publication of chemical compendia in the English language was remitted to the General Committee of Chemical and Allied Societies. At a meeting of this body in March 1918, the following resolutions were adopted:

i. That in the opinion of this meeting it is expedient to publish an English work of reference completely covering scientific and industrial chemistry on lines similar to those of Beilstein;

ii. That this resolution be communicated to the corresponding American chemical societies and their co-operation invited.

At this meeting, an executive committee was appointed to draw up a report on the scope, organisation and cost of the proposed compendia. This report, submitted to the General Committee of Chemical and Allied Societies in November, was adopted in an amplified form as a Final Report on January 30, 1919. Copies of this Final Report, as also of the earlier one, were sent to the American Chemical Society, with which body as with American chemists generally the closest co-operation is desired; copies of the Final Report were also sent by the Chemical Society to the corresponding Societies of Paris and Rome with the view of eliciting support for the scheme from French and Italian chemists.

Briefly, what is proposed is the compilation and issue of two compendia in the first instance—one for organic and the other for inorganic chemistry. The former is projected on the model of Stelzner's Literatur-Register, but containing more detailed information than that book and with complete references to original sources; the latter, by following Gmelin-Kraut's or Abegg's mode of treatment of the material, is to be the more readable. Arrangements have been suggested for ensuring rapid publication of the volumes dealing with organic chemistry covering the period from 1909 to the present time and for the publication of supplements at regular intervals.

How far these plans, and others for the compilation of patent and other literature of the Allied countries can be placed on an inter-Allied basis, and effect given to them in the near future, is one of the problems to be discussed at the London meeting of the Inter-Allied Federal Council. It may be hoped that simultaneous publication in English and in French may solve the difficulty in which American, British, French and Italian chemists find themselves placed as one of the consequences of the war and, incidentally, serve to falsify yet one more German prediction (*v.* Le Blanc, "Zentralblatt," June 26, 1918) to the effect that, "as no other nation at the present time commands such organised information as is furnished by German handbooks and literature-registers, it is practically impossible for the initial German advantage to be made up."

An opportunity such as the present is not likely again to arise, and if it be seized with something of the energy which, in other directions, has won the war for the western nations, it will no longer be true—again to quote Le Blanc—that "every foreign student is compelled to fall back on German chemical literature and in this manner chemistry acts as a missionary of the German language." No longer is it tolerable to suffer this type of German penetration in the field of pure and applied chemistry, to the development of which the inter-Allied nations have made so large and fertile a contribution.

CONDITIONS CONTROLLING THE SUCCESSFUL CULTIVATION OF THE SUGAR BEET.

J. P. OGILVIE.

In the United States the beet sugar industry is now firmly established. During the year 1917-18, the number of factories operating was 91, the area cultivated was 664,797 acres, and the total quantity of sugar manufactured was 765,207 tons. Practically all this production was "white granulated," that is a grade of sugar of sufficiently high quality to be directly consumed without passing through the refinery.

A considerable time elapsed, however, before it was possible to regard the position of beet cultivation in America as fully assured, and the history of its establishment provides the most instructive lesson possible to us who desire to see the industry founded in this country. Those who have studied the question must have been impressed with the fact that it is much more complicated than might at first sight appear. It has been demonstrated convincingly that crops of beet at least as large per acre, and at least as high in sucrose content, as on the Continent can be cultivated in the United Kingdom; while it is equally certain that the extraction of the juice from the roots and its conversion into commercial sugar in the factory could be carried out here as well as elsewhere. But this is by no means the whole question. On coming to consider the larger problem of the cultivation of the beet by farmers on an industrial scale for manufacture in competition with other sources of supply, one realises that there are many conditions that must receive careful attention.

Dr. Harris' recently published book* treats in the main of the practice of cultivating and harvesting the beet, and is written more particularly for the use of the farmer; but it also contains information dealing with the economic conditions which in America have been found to control the successful carrying on of the industry. Most of these conditions must be met also by us on this side if commercial success in this direction is to be achieved; and a brief review of them, therefore, would seem to be opportune at this time when at last the Government has introduced fiscal legislation definitely favourable to the foundation of the industry in the United Kingdom.

It is made very clear that the life of the industry depends upon the efficiency of the farmer, who must receive education in the special methods followed in this branch of cultivation. Every operation from the ploughing of the land to the delivery of the roots calls for skill and painstaking care, and none can be slighted without being reflected in the returns. Dr. Harris remarks (page 51) that "the farmer who would succeed must get down on his knees and use his fingers, almost fondling each plant, and if he is not willing to do this he will not make a good beet farmer." As the high sucrose content and purity of beets are artificial characters produced by years of special cultivation, selection, and breeding,† the quality of the crop is subject to modification by cultural methods. It not only responds readily to good treatment, but it quickly deteriorates under bad. In therefore considering the advisability of establishing a factory in a particular district, consideration should be given to the farmers who will raise the roots, the methods to which they have been accustomed, and their possible adaptability to the new practice.

Not only must the farmer be trained to be efficient in his methods, but he must be urged to show an attitude of enterprise in order to lower working costs. Beet sugar manufacture, it should always be borne in mind, operates more or less in competition with cane sugar produced on colonial plantations, where labour is cheap, and where moreover, methods of agriculture and manufacture are constantly being improved.* It is pointed out (page 232) that "if we are to produce sugar in competition (with that made from the cane), it is essential that our labour should be made as efficient as possible by the use of machinery, and the application of scientific methods to the farm. . . . It is on the farm that this greater efficiency must be sought, since the price paid for the roots is the chief item of expense involved in the cost." On the other hand, the cost of actually manufacturing the sugar from the roots is a fairly constant value, and is easily estimated and controlled. The success of this branch of the industry may safely be left in the hands of the experienced technologist.

There is the important question of labour of a suitable kind, of which a sufficiency at a reasonable rate must be assured. In America it has been found that the hand labour involved in the cultivation of the beet is more than ten times that required for wheat, five times that for corn, and twice that for potatoes; while the horse labour is three times that used for wheat, oats, and barley. Again it is insisted (page 48) that "since manual labour constitutes nearly half the total cost of growing beets, and since more than two-thirds of this comes at the time of thinning and harvesting, it is imperative that as many labour-saving devices as possible be used." It is pleasing to note that relief at the harvest season to some extent seems to be in sight, for a number of mechanical toppers are proving successful, though there still remains the labour expended in blocking and thinning. In these two operations, as well as in topping, children can be employed to advantage, finding in this way work that is at the same time remunerative and healthful.

Among the other conditions controlling the successful cultivation of the sugar beet discussed by Dr. Harris may be mentioned the question of capital, for beet raising requires more than most other crops. Special planters, cultivators, harvesters, and the like are required, upon which a certain amount of money must be expended before returns are obtained. It, therefore, frequently becomes necessary for advances to be made to the farmer; or, alternatively, for the sugar company to furnish implements, and also to render other financial aid during the growing season.

In America it is noticeable that in many districts beets are not grown, in spite of the fact that the soil may well be adapted for the purpose. This circumstance is due to the competition of other crops, and generally can be observed in parts near large towns, greater financial returns to the farmer being obtainable from market garden crops. Transport of the roots is an important factor in the States. If roots are cultivated more than a certain distance from the factory, the railway must be accessible, for ordinarily it is found that beet cannot be advantageously hauled more than two or three miles. Lastly, there is the obvious condition that a certain supply of roots from season to season must be assured from the farmers in the particular district in which the factory is to be located.

* "The Sugar Beet in America." By F. S. Harris, Ph.D., Director of the Utah Agricultural Experiment Station. (The Macmillan Company, New York.) 1919. Price $2.25.

† An outline of the manner in which selection and breeding are effected was recently given by F. V. Darbishire (this J., 1919, 21 R).

* Cane sugar imported from the insular possessions of the United States (Hawaii, Porto Rico and the Philippines) pays no duty, while that from Cuba is admitted at a reduction of 20 per cent. from the rate imposed upon sugar from other foreign countries. Home-produced beet sugar, therefore, is in direct competition with cane sugar from these sources, and also with that made in the Southern States, namely Louisiana and Texas.

These briefly are the more important conditions that have been found to obtain in America during the years taken to place the beet sugar industry in its present established position. They resolve themselves generally into the education of the farmer; the organisation of labour; and the provision of capital. In order to overcome the difficulties involved in carrying them into practice in this country, and thus to avoid discouraging failures at the outset, it would seem desirable, in fact necessary, that concerted action should be taken to meet them. Already the Government has guaranteed financial assistance in the erection of a factory at Kelham, Nottinghamshire,* but it is much to be hoped that State aid will be further extended in the way of directing and assisting the efforts that may soon be made to promote the British beet sugar industry.

At the present moment much might be learnt from a general examination of the methods of beet cultivation (and perhaps also of sugar manufacture) followed in other countries, and this is a matter that might be directed by the Government. On the Continent it has been the custom in the beet sugar industry for years past when it has become necessary to investigate technical matters that from time to time have arisen, such as the combating of plant diseases, or the adoption of improved devices in the field or factory, to appoint a small commission for the purpose of reporting upon the prevailing practice elsewhere. It is certain that a visit to other countries of two or three British agriculturists and technologists in order intimately to investigate the present conditions there would at this time be productive of information of the most useful kind.

In conclusion, some of the many benefits that have been found to accrue from the establishment of the beet sugar industry in America and elsewhere may be mentioned. Mr. Truman G. Palmer, a recognised authority on the subject, recently wrote† "For 15 years I have made a personal study of the sugar industry in the United States, Germany, Austria-Hungary, Russia, France, Belgium, Holland, Denmark, Sweden, and some portions of the tropics. In the above named countries of Europe, I have met or studied the writings of their leading agriculturists, economists, and other thinking men, and without exception they state that the culture of sugar-beets raises the standard of their agricultural methods as does no other crop, rids their fields of noxious growths, puts their soil in better condition, increases by 25 to 80 per cent. the average yield of all other crops grown in rotation. . . . In no beet country visited was there found a disposition to regret its establishment, or the money it cost to establish it."

Dr. Harris also has observed that in the States beet production has stabilised the industry of agriculture in different parts, affording farmers an assured market for a crop, the cost of producing which can be calculated with a fair degree of accuracy, whereas the profits from certain other kinds of produce are less secure. Beet cultivation demands deep ploughing, and the result is that the crop following in the rotation is benefited in a marked degree. It promotes efficient farming generally, since at every stage thoroughness is necessary, this being reflected in the raising of other crops. During the winter months employment is given in the sugar factory to many who might otherwise be idle. Increased business to a number of other industries not directly connected with the farmer is promoted, such as those concerned with transport, machinery and plant construction, and fertiliser manufacture. Cheap cattle foods made from the by-products of the farm and factory are provided, and several secondary industries arise from the use of sugar-house products. Finally, one of the most important contributions of the beet-sugar industry to the welfare of the general community is that it assists in ensuring national dependence in the supply of a most necessary article of food. After our experience in regard to the sugar supply of this country during the war, it is hardly necessary to elaborate this point. It is one which literally has been brought home to every one of us.

* This J., 1918, 77 R.

† *Journal of the National Institute of Social Sciences*, July, 1916.

SOME RECENT ADVANCES IN THE MEASUREMENT OF HARDNESS IN METALS.

F. C. THOMPSON.

As Le Chatelier has pointed out, the property of hardness, since it obeys neither the law of addition nor that of equivalence, cannot be measured in terms of any absolute unit. Two materials which appear equally hard on one scale generally appear unequal when referred to another. It is therefore only possible to refer this property to certain well-defined empirical scales which admit of comparative results being obtained. In these circumstances it is not surprising that a generally acceptable definition of hardness has not been formulated; but that due to Sir Robert Hadfield—"hardness is resistance to deformation"—is sufficient for practical needs.

The static hardness tests include the well-known Brinell test, in which a hardened steel ball commonly of 10 mm. diameter is forced into the sample under a given load of, for the harder metals, usually 3000 kilo., and for the softer ones 500 kilo. The hardness number is then defined as the ratio of the load in kilo. to the spherical area of the impression produced in sq. mm. In Ludwik's test a 90° cone is substituted for the ball, the hardness being as before taken as the ratio of the load to the conical area of the indent, *i.e.*, $\frac{P}{\pi a^2 \sqrt{2}}$ where a is the radius of the impression. The superiority of this test over Brinell's lies in the fact that the deformation produced is geometrically similar for all loads. A test suggested by Auerbach in 1891, which although it has not found much practical application might yet in certain cases be of value, is one in which two similar samples of the material under test, either in the form of cylindrical or square bars, are pressed into each other, the load per unit of flattened area being taken as a measure of the hardness.

The unsatisfactory nature of the Brinell test as a measure of hardness is shown by the fact that the value obtained, so far from being a constant for a given material, varies with the diameter of the ball used and the load applied. Thus for equal loads the smaller the ball, and for the same sized balls the higher the load, the greater is the hardness numeral obtained. The time during which the maximum load is applied is also a cause of variations, especially with very soft materials. Thomas has shown that, for a very soft steel, the Brinell number under otherwise constant conditions of test may change from 128 to 115, according as the load is applied and at once removed, or is left on for 10 minutes, respectively. For harder materials, the time factor becomes of much less importance except in the first few seconds of the test, the Brinell number for a tempered nickel-chrome steel changing only from 340 when the pressure was maintained for 10 seconds to 335 after 2 minutes.

The variations produced by altering the diameter of the ball or the load applied arise in part, at any rate, from the fact that the deformations produced under varying conditions are not geometrically similar. It has therefore been repeatedly suggested during recent years that the *modus operandi* of the test should be altered so that a definite degree of deformation should be produced and the load required be measured. This method, although undoubtedly superior to that in use in the standard test, is applicable chiefly to special purposes only, since it is possible to obtain a result in one operation only when the depth of the indentation is automatically recorded—a method which has not received a very cordial reception. When the diameter of the impression is measured at least two tests and a calculation are necessary. It must also be borne in mind that on account of the extrusion of metal around the indentation, hardness numbers calculated from the depth and diameter, respectively, do not coincide, the former being rather higher as is illustrated in Table I.

TABLE I.

Material	Hardness no. at 900 kilo. calculated from depth	Hardness no. at 900 kilo. calculated from diameter
Mild steel ...	126	111
Rail steel ...	197	174
Cast iron	235	190

As examples of the tendency to modify the Brinell test by working with a constant deformation, it may be mentioned that the U.S. Bureau of Standards has used as a measure of hardness the load in kilo. required to produce an impression one mm. deep, while Martens adopts a standard indent 0·05 mm. deep with a ball 5 mm. in diameter. The latter excessively small deformation is in line with the view now rapidly gaining ground that the impressions often used at the present time are far too large.

The influence of the load in determining the Brinell number has been investigated by a large number of workers. According to Benedicks, if H_o is the hardness number with a load P_o and H the corresponding number under a pressure P, then $H_o - H\frac{\kappa + P_o}{\kappa + P}$ where κ is a constant, which for steels is about 1000. A most interesting research by Greenwood on the hardness of copper-aluminium alloys leads to the following conclusion:—The hardness (Brinell) of any material measured with a standard 10 mm. ball and a load of P kilo. can be expressed by an equation of the general type $H = \kappa + P^{x}$, where κ and x are constants depending on the substance under test. For a copper alloy containing 10 per cent. of aluminium $H = 39 + P^{0·17}$, while for mild steel $H = 80 + \sqrt{P}$. It is of interest in this connexion to note that, as was pointed out by the present writer, the constant κ is a function of the elastic limit of the material, $0·3\kappa$ being a rough measure of the yield point. It may, therefore, be said that the Brinell number under any load is the sum of two factors, one of which is a function of the elastic limit while the other is dependent on the extent to which the material is hardened by cold work.

An empirical relationship has recently been pointed out by Russell, who has shown that for a very wide range of materials $P = aV$, V being the volume of the indentation produced by a pressure P, a and m being constants for each material. The value of m is almost 0·6 for most of the materials tested. For Greenwood's 10 per cent. copper-aluminium alloy, $P = 1000\ V^{·62}$, and for a 0·3 per cent. carbon steel $P = 1169\ V^{·577}$, the volume being measured in cu. mm. From the relationship $P = aV^{m}$ when V is unity $P = a$, and a new hardness number is therefore defined by Russell as the load in kilo. which will displace 1 cu. mm. of the metal. This formula is similar in type to that of Meyer, who showed that $P = ad^{n}$, n being a constant for a given material, d the diameter of the impression produced under a load P, and a a constant for a given material and given diameter of ball.

When the depth of impression is plotted against the corresponding load it has been shown by Bateson that the graph obtained consists of an initial curved portion which is succeeded by a straight line. From the slope of the latter, hardness numbers are obtained which are independent of the load. By this means, therefore, values can be obtained with lower loads on soft materials comparable with those obtained under standard conditions on steels—a conclusion of considerable importance.

Passing on to a consideration of the size of the ball used, Moore has shown that from two impressions under loads P and P_1, which produce indents of diameter d and d_1 with the same ball of diameter D, the hardness number corrected to standard conditions is given by $H = \frac{16PD^{n-2}}{\pi (2d)^{n}}$ where n is a constant, between 2 and 2·5, depending on the material and equal to $\frac{\log. P_1 - \log. P}{\log. d_1 - \log. d}$. Using this formula results have been obtained with a 4·76 mm. ball, which coincide with those from the standard test, and with those resulting from the Ludwik cone test.

This hardness figure is calculated from the *projected* area of the indentation, *i.e.*, $\frac{\pi d^2}{4}$, and not the spherical area. The corresponding Brinell number is obtained by multiplying this result by 0·933. The use of the plane projected area has also been advocated by Unwin, who pointed out that by its use in the Brinell and the Ludwik tests the hardness numbers should be the same in both cases. Experiments, however, have shown that, when calculated in this manner, the values are not the same, the Ludwik hardness being in general lower than the Brinell. The following table gives an idea of the relation of the numbers obtained in the standard Brinell test to those obtained by calculation from the projected area $\pi\frac{d^2}{4}$.

TABLE II.

Diameter of indentation	Brinell no.	Hardness no. calc. from $\frac{\pi}{4} d^2$
2·5 mm.	600	612
4·0 ,,	228	239
6·0 ,,	95	106

In the determination of the hardness of very small specimens a 10 mm. ball is inapplicable, and an ingenious modification of the test due to Dr. T. Baker allows of results being obtained with small balls, say 1 mm. in diameter, identical with those derived in the normal test. So long as the ratio of the load to the square of the diameter of the ball is maintained constant the diameter of the impression is directly proportional to that of the ball. The accuracy of the statement is shown by the following results:—

TABLE III.

Diameter of ball	Load in kilo.	Diameter of impression	Brinell no.
10 mm.	3000	4·75 mm.	159
7 ,,	1470	3·33 ,,	158
5 ,,	750	2·35 ,,	163
1·19 ,,	42·5	0·567 ,,	158

Considerable amount of attention has lately been paid to impact hardness tests. It was shown by Roos that, using a ten mm. ball as the indenting tool, the energy of the blow is proportional to the square of the spherical area of the impression. A more general relationship, due to Martel, which applies equally to ball or cone tools, defines the dynamic hardness number as the ratio of the energy of the blow in kilo. to the volume of the indentation in c.c. This definition has been adopted by Edwards and Willis in their recent work on this subject, in which a falling weight with an impact energy of 63 inch-lb. to which a 10 mm. ball is rigidly fixed produces the indentation. The relationship of this test to the standard Brinell is given by the formula $H = \frac{7582}{d^3}$, where d is the diameter of the impression produced by the impact.

It was also shown by these investigators that when the energy of the blow E was altered $\frac{d}{\sqrt[4]{E}}$ is a constant for each material. The technical value of the impact hardness test is evident in that the time factor is completely eliminated, and secondly that by its means hardness tests may be made on metals at high temperatures. The hardness of a given material, however, when measured under dynamic conditions according to Martel's formula is always appreciably higher than when determined under the standard static test. For most materials the ratio of the dynamic to static values is somewhere about 1·5, though for cast tin it is 4·3, for cast zinc 2·84, and for "Armco" iron 2·06.

Of the tests which are dynamic in character, the Shore scleroscopic method is by far the most important. A diamond-faced hammer weighing about 40 grains drops upon the specimen under test from a given height, the height of rebound being used as the hardness number. The area of the indenting point is stated to be $\frac{1}{2500}$ sq. in. A slight permanent indentation is produced, the height of rebound being diminished as the work spent in doing this is increased. The Shore and Brinell values for the same material bear no very constant relation to each other, the average value of the ratio of the Brinell to the scleroscopic hardness number being approximately shown in the following table:—

TABLE IV.

Brinell no.	Ratio of Brinell to scleroscope values.
150	5
300	5·7
450	6·3
550	6·6
700	7·2

CORRIGENDA.—"Recent Iron-Ore Developments in the United Kingdom." In the analyses of Jurassic ironstones on page 221 R (issue of June 30), insert "moisture" in lieu of "water (combined)"; and the average percentage of silica in Northamptonshire ironstone should read 14.7, instead of 11.7.

PROLONGATION OF PATENTS.

A patentee may present a petition to the Court praying that his patent may be extended for a further term, and in considering the petition the Court shall have regard to the nature and merits of the invention in relation to the public, to the profits made by the patentee as such, and to all the circumstances of the case.

The object of this provision of the existing law is apparent. The intention of the patent grant—that the inventor shall have opportunity of obtaining reward—frequently fails. Where this is due to circumstances over which the patentee has no control it is only fair that he should be given a further opportunity, always with due regard to his original merit and the degree of his want of success.

The petition to the Court involves a searching inquiry, it being of the utmost importance that accounts with reference to the working of the patent should have been kept and should be produced to the Court. Thus the expense of the proceedings is considerable.

The exigencies of war have prevented many patentees from working their patents, and those who think fit to petition the Court for an extension of the term will undoubtedly find this fact much in favour of the petition.

To patentees, however, this does not appear sufficient. In the majority of cases the circumstances over which the patentees had no control were the direct action of the Government in commandeering their works, in refusing to supply material, in conscripting the patentee himself and the like. Why should the patentee be put to the expense and trouble of an elaborate inquiry to show that had it not been for the war he might have been sufficiently remunerated?

Thus there has arisen a demand for some procedure simpler than the petition to the Court for obtaining an extension rather as a redress for a grievance than as an act of grace born of sympathy.

The demand seems rational. The patentee is not in the same position as the ordinary manufacturer or trader. The misfortunes of war have affected these also; but in making good they are not limited by man's decree.

It is not the principle at stake that creates difficulty, but the mode of applying it. There are those who advocate a simple plan; they would add automatically, or at all events on demand, to the life of the patent that portion of its life which was lived during the war. Unfortunately the problem is not so simple as the proposed solution.

As nearly as can be ascertained, in 1915, some 594 patents attained their fourteenth year and expired; in 1916, 596; in 1917, 653; in 1918, 804. If each of these is to be resuscitated for 3, 2 or 1 year, as the case may be, what is to be the position of those who have started manufacture during the lifeless period?

Again, the hardship which it is desired to alleviate is not universal, or uniform; there are patents which have been worked during the war even more profitably than previously; others have only partially suffered. In justice to the public some patents should be excluded from the proposed extension; others granted it in minor degree; but how is the Comptroller to differentiate?

It is to be feared that a judicial inquiry at which objectors may be heard cannot be avoided. What is certainly required is a less costly and exhaustive inquiry than the current procedure before the High Court; for this the reformers should press.

AN anonymous gift of $1\frac{1}{2}$ million dollars has been presented to Cornell University, U.S.A., for the establishment of new chemical laboratories.

THE SECOND BRITISH SCIENTIFIC PRODUCTS EXHIBITION.

The opening ceremony took place at the Central Hall, Westminster, on July 3. Lord Sydenham, president of the British Science Guild, under whose auspices the exhibition is being held, presided, and was supported by many distinguished representatives of pure and applied science. The speakers included the Rt. Hon. the Marquess of Crewe, the Rt. Hon. Lord Moulton, Sir Philip Magnus, and Sir Richard Gregory (chairman of the Organising Committee). Lord Crewe, in opening the exhibition, dealt, *inter alia*, with the means of preparing students to take an early part in industrial life. The pursuit of definite industrial courses during vacations had always seemed to him to be a particularly hopeful plan. The custom of taking small bodies of selected students on tours for terms of 6—8 weeks to works was also to be recommended; and thirdly, there was the system of industrial fellowships for post-graduate workers.

Lord Moulton referred to the methods by which Germany had attained her conspicuous position in trade and industry before the war. First, she was far more skilful than we were in forming trade combinations to monopolise the raw products of industry; secondly, she outwitted us in the art of salesmanship; and thirdly, Germans applied themselves with greater assiduity to the elaboration and perfection of details, so that they succeeded in producing articles of superior and more uniform quality. We were like an old-established house; they were like a young house that wanted to make business. The experience of the past five years had convinced him that there was no limit to the capabilities of our workers, provided they could be roused to action; there was nothing they need fear—except themselves.

The Exhibition catalogue—a bulky volume of over 300 pages—contains, in addition to a full list of exhibits, an excellent account of the war-work which has been done in the laboratories of the universities, technical colleges and research institutes, and by a few industrial firms. Another valuable feature is a full and up-to-date catalogue of scientific and technical books. In an introductory article, Sir R. Gregory explains the *raison d'être* of the exhibition. Whereas that held last year demonstrated this country's emancipation from dependence upon enemy countries in respect of many vital industries, this year's exhibition is designed to promote the further development of those industries, as well as to encourage the establishment of new ones founded on progressive science and invention. The Exhibition will be open daily at the Central Hall, Westminster, until August 5, from 11 A.M. to 7 P.M., and on Saturdays from 12 A.M. to 9 P.M.

MEETINGS OF OTHER SOCIETIES.

THE ROYAL INSTITUTION.

The last Friday discourse of the session was delivered by Prof. Sir E. Rutherford on June 6 on "Atomic Projectiles and their Collisions with Light Atoms."

The lecturer first directed attention to the enormous energy associated with the fast moving α and β particles ejected from radioactive sources. He had introduced a modification of the "nucleus atom" as the result of experiments concerned with the scattering phenomena produced by the impact of such swift moving α particles upon various surfaces. The atom he conceived as constituted of a positive charge concentrated in a minute nucleus, the size of which however increased with the atomic weight, and surrounded by one or more rings of electrons, the radii of the rings being very large compared with nuclear dimensions. The deflection of α-particles owing to impact upon substances such as gold had led to the conclusion that in such impacts the α-particles were unable to penetrate into the immediate neighbourhood of the nucleus of the target atoms. The distance of approach was of the order of 10^{-11} cm. and the inverse square law of attraction and repulsion had been abundantly verified at these minute distances.

The method of scintillations has been applied to determine the range to which atoms were ejected from various substances by "head-on" impact therewith of fast moving α-particles. Discussing more particularly the impact of such α-particles with lighter atoms, it was pointed out that after such impact, the α-particles and the ejected atom would move in the original direction of impact, the ejected atom moving the faster. An investigation of such impacts in the case of hydrogen led to the conclusion that the respective nuclei approached with 3×10^{-13} cm. of one another, resulting in the ejection of constituents of the nucleus itself from the hydrogen atom. A helium atom is composed of a nucleus of 4 hydrogen atoms together with 2 electrons. It survived whole after collision with other atoms. No evidence of helium débris after impact of α-particles had hitherto been obtained. In the case of ejectment by impact upon atoms of oxygen or nitrogen curious results had been obtained. The number ejected from the atoms of nitrogen steadily decreased as the range of ejection increased from 7 to 9 cm. Thereafter, the number ejected to increasing ranges diminished very slowly as the range increased up to 28 cm. The only possible conclusion from the results obtained over this extended range (the calculated maximum range of ejection for the N atom is 9 cm. while that for H is 28 cm.) is that the particles so projected from nitrogen are constituted of atomic hydrogen, or H_2 or H_3. The hydrogen, the lecturer speculatively imagines to arise from the nitrogen atom, this being constituted of three helium atoms and two hydrogen atoms. This view does not necessarily mean that nitrogen was not an element but rather that it was an element in a particular condition. Advance in the study of atomic impacts would be materially assisted were α-particles discovered possessing a very much larger range than those hitherto available.

SOCIETY OF GLASS TECHNOLOGY.

The June meeting was held at the University, Sheffield, on the 18th inst., the President, Mr. S. N. Jenkinson, in the chair.

Mr. Jenkinson addressed the meeting on "Impressions of a Recent Tour of the German Glass Factories." During his tour in Germany he visited Silesia, Saxony, Saxe-Weimar, and other districts, investigating the conditions in the factories, and particularly in the glass works. The size of the ceramic industry in Germany in pre-war days can be judged from the fact that in 1913 it exported glass to the annual value of 123 million marks and pottery to the value of 94 million marks; 75 per cent. of the output was exported. Hence the outbreak of war caused the shutting down of many factories. The policy during 1915-16 was to re-open several of the glass factories, and allow one furnace in each works to be kept going, and a scheme was inaugurated whereby finance in the industry was pooled. At the present time there is very little production of glassware owing largely to the lack of coal and the state of transport. Stocks are very low. Throughout the visit he was very much impressed by the fact that all the plant in the works was kept at the highest pitch of efficiency, so that immediately opportunity came a high rate of pro-

duction would follow. This fact will have to be taken into account by British manufacturers. Out of some 132 furnaces, concerning which he made inquiries, only about eight were working.

Dr. M. W. Travers then gave a short account of "Some Experiments with a Gas Fired Pot Furnace." He described furnaces which had been used in producing chemical glassware, and advocated burning the gas from the producers in front of the pots, and taking the burnt gases out of the furnace at the back.

Dr. Turner followed with a paper on "The Properties of British Fireclays suitable for Glass Works Use. Part 1.—The Variation of Shrinkage, Density, and Porosity with Temperature." (Preliminary communication.) By E. M. Firth, F. W. Holden, and W. E. S. Turner. This paper was well illustrated by assemblies of fireclay blocks showing the behaviour of various fireclays under the tests outlined by the authors. The paper is the first communication of a research carried out under the auspices of the Refractories Research Committee of the Society.

A third paper entitled "The Examination of Optical Glass in Relation to Weathering Properties," by A. V. Elsden, O. Roberts, and H. S. Jones, was taken as read, and will be published in the Journal of the Society in due course.

The above meeting ended the session. The first meeting of the next session will be held in October.

NEWS AND NOTES.

CANADA.

Manufacture of Ferro-Molybdenum.—Since March, 1916, 100,000 lb. of 70 per cent. ferro-molybdenum has been produced for the Imperial Munitions Board by the direct smelting of molybdenite concentrate at the works of the Tivani Electric Steel Co., Bellville, Ont. Vertical cylindrical furnaces of the single-phase type are employed, requiring 3000—4500 amp. at 50 volts per furnace. Each consists of an iron shell, lined with red brick, firebrick, silica brick, and carbon in succession, and resting on a concrete foundation. The lower electrode consists of a water-cooled bronze or copper block from which iron rods project upwards into the furnace bottom, and the upper electrode of a graphite or carbon rod. For the production of 70 per cent. alloy from concentrate containing MoS_2 75 and Fe 9 per cent., the charge consists of concentrate 100, lime 120, coke 10, and scrap steel 5 lb. Each furnace is tapped every 4 hours, the output being 1050 lb. of alloy per 24 hours.—(*Trans. Canadian Mining Inst.*, 1918, *Vol.* 21, 154—160.)

Progress of Chemical Industries.—The Department of Trade and Commerce through its Bureau of Statistics has in course of preparation a booklet giving a summary of the chemical industries of Canada. Plants connected with chemical and allied industries are distributed as follows:—

Nova Scotia	30
Prince Edward Island ...	2
New Brunswick	20
Quebec	161
Ontario	293
Manitoba	38
Saskatchewan	8
Alberta	21
British Columbia	61
	634

The striking growth of chemical industries within the Dominion during the last six years is shown by the following tables:—

I.—*Exports of Canadian Drugs, Dyes and Chemicals for the fiscal years* 1912–1919.

Year	British Empire	Foreign	Total
	$	$	$
1912	827,500	849,716	1,677,216
1913	1,066,158	734,279	1,800,437
1914	841,566	888,637	1,730,203
1915	955,156	2,588,545	3,543,701
1916	1,398,832	5,050,313	6,449,145
1917	1,719,972	7,498,443	9,218,415
1918	2,765,292	11,442,317	14,207,609
1919	4,300,142	12,752,932	17,053,074

II.—*Imports of Drugs, Dyes and Chemicals from* 1912 *to* 1919.

Year	British Empire	Foreign	Total
	$	$	$
1912	2,806,555	9,789,296	12,595,851
1913	3,417,468	13,093,875	16,511,343
1914	3,201,277	11,437,012	14,638,289
1915	2,878,322	10,570,745	13,449,067
1916	3,034,277	14,060,648	17,094,925
1917	4,873,226	22,726,987	27,600,213
1918	3,636,024	22,886,148	26,522,172
1919	4,003,513	28,785,191	32,788,704

Oil Exploration in Alberta.—It is understood that many Canadian business men are actively supporting exploration work on the potential oilfields of Northern Alberta, where over twenty different parties are now operating. So far only heavy oils have been struck, but it is possible that lighter oils will be found in the lower levels. The Dominion Government is supporting development work by loaning a special drilling plant capable of testing formations down to 3000 ft. All duties on well-drilling outfits from the United States have been revoked, and these portable outfits are being taken to the Peace River country in large numbers.

AUSTRALIA.

New Chemical Enterprises in Western Australia.—The Portland Cement Company of Western Australia is now erecting works in that State for the manufacture of Portland cement, agricultural lime and allied products. The Company has a capital of £185,000 and has secured the rights of extensive limestone deposits in Western Australia.

Investigations of the resources of Western Australia have been recently carried out on behalf of Messrs. Brunner, Mond and Co. with a view to establishing alkali works in the State.—(*Official.*)

SOUTH AFRICA.

The Coal Industry.—The quantity of coal exported last year was 1,208,000 short tons, valued at £1,033,000, as compared with 856,000 tons, worth £337,000, in 1913. Many new markets have been found for South African coal during the war, considerable quantities having been sent last year to Argentina and Uruguay as well as to the British East Indies and Egypt, though consignments to Portuguese East Africa fell off considerably. On the other hand, less coal for bunkering purposes was shipped last year—*viz.*, 1,276,000 short tons, as against 1,452,000 tons in 1913, although increased prices caused the value to rise from £1,052,000 to £1,906,000.—(*Official.*)

Exports of Wool.—Nearly 116,000,000 lb. of sheep's wool, valued at £9,700,000, was shipped from the Union last year as against 177,000,000 lb. and £5,700,000 in 1913. The United States took one-third of the total, whilst the United Kingdom took a little more and Japan rather less than a fourth each. The exports of mohair at 19,600,000 lb. were about 12 per cent. more in quantity but nearly double the value of the 1913 exports. The United Kingdom received the main bulk, but

there was a large increase in the sales to the United States.—(*Official.*)

Candle Manufacture.—There are six candle factories in the Union producing 14,600 short tons, valued at £626,000. The imports are negligible. The kinds of candles produced are stearin, paraffin, and sperm, which consist of paraffin wax with 10 to 20 per cent. of stearin. Commercial stearin, a mixture of palmitic and stearic acids, is made in the Union, chiefly from synthetic tallow obtained by catalytic hydrogenation of whale oil, but some is produced from the oil of the Mafurra bean. The fat or oil is saponified in autoclaves under pressure, and the fatty acids being dark, are distilled in superheated steam. To prevent theft, candles used in the gold and diamond mines, and sometimes their wicks, are specially coloured. In addition to glycerin, "oleine," *i.e.* commercial oleic acid, is a by-product. Oleine is useful for lubricating wool in spinning, but is not in demand for this purpose in South Africa; it is therefore employed in soap-making. Hydrogen for hydrogenation is obtained by the electrolysis of water, and the accompanying oxygen of 99 per cent. purity is employed for acetylene welding. There is at present a shortage of calcium carbide, and of tools for cutting and welding, but when times become normal a large local demand for oxygen is to be expected.—(*S. Afr. J. Ind., Dec.,* 1918.)

UNITED STATES.

American Engineering Standards Committee.—This Committee has recently revised its constitution, and after ratification of the same by the various constituent societies, will be known as the American Engineering Standards Association. The Association is constituted of representatives of the American Institutes of Electrical, Mining and Metallurgical, Civil and Mechanical Engineers respectively, together with representatives of the American Society for Testing Materials, and the Government Departments of War, Navy and Commerce. The Association, amongst other objects, seeks to co-operate with similar organisations in other countries to secure an international status for approved American engineering standards. Formulated standards may be submitted to the Association for approval or otherwise by any organisation. Scientific standards and standards of a commercial character submitted for approval by any organisation will be considered by specially constituted sectional committees. The Association may call together all who would be interested in the formulation of a new standard, and will safeguard that sectional committees are balanced and representative. After approval, a standard is to be described as "Approved by the American Engineering Standards Association." The approval may be designated as either "Recommended Practice," "Tentative Standard" or "Standard," the last indicating general acceptability. The Association will also act as a bureau of information in standardisation, and function as an intermediary whereby any organisation intending to define a standard may get into touch with others similarly interested. The address of the Association is 29, West 39th Street, New York.

Durability Tests of Wearing Apparel.—Research chemists are now devising laboratory tests on wearing apparel which can be interpreted in terms of durability and which will be duly standardised. Enough data has been collected regarding fabrics of known history to justify the use of tensile strength, stretch, resistance to bursting, composition and similar tests. The relation of mechanical construction to wear is, of course, well known, especially in pile fabrics, and experiments leading to the discovery of a test for friction wear and "shine" on fabrics are well under way. Ultra-violet light is still widely used to determine fastness to light, but it leaves something to be desired since there is doubt if it adequately represents weather conditions.

Chrome Ore Statistics.—The U.S. Geological Survey reports that the total production and shipment of chrome ore in the United States in 1918 was equivalent to 63,000 (long) tons of ore of 50 per cent. grade; and unsold stocks at the end of the year were equivalent to 30,000 tons of the same grade. Imports of chrome ore in 1918 were nearly 28,000 tons more than in 1917, amounting to over 100,000 tons. The principal countries of origin were Rhodesia, New Caledonia and Brazil. The average cost per ton at the shipping port was $28.17, but the ore from Canada (20,949 tons), much of which was of low grade, averaged $31.56.

Recovery of Used Lubricating Oil.—The Midwest Engine Co. of Indianopolis has successfully utilised the following method of recovering spent lubricating oil. After the oil has been left to stand in barrels to deposit sediment, it is drawn off into reclaimer tanks which are heated by gas burners to expel the water and lighter oils. The heating also causes further sedimentation of suspended solids. When the oil is near the boiling point a gas flame from a torch is played upon it. Thousands of gallons of good oil have been recovered by this process. The recovered oil has practically the same composition as the original oil.—(*Amer. Gas Eng. J., May* 10, 1919.)

The Dye Industry of the United States.—The Norwegian Embassy at Washington reports that last year the American dye industry satisfied the immense civil and military requirements and produced an excess available for export of the value of more than 10 million dollars. Quantity having been the aim during the war it will now be sought to improve the quality; already 160 types of dyes—said to be equal to the German products—can now be produced, compared with 900 types sent out by Germany before the war.—(*Z. angew. Chem., May* 16, 1919.)

GENERAL.

The Inter-Allied Federal Council for Pure and Applied Chemistry.—Following the initial gathering of international delegates held in Paris in April last, the first meeting of the above Council is being held in London from July 14–18, by the invitation of the Society of Chemical Industry. The Court of the Worshipful Company of Salters has kindly offered the necessary accommodation for the five meetings of the Council. At the time of writing the exact number of delegates attending the Conference is not known with certainty, but it is understood that the following are among the principal representatives of the countries named:—France. Prof. C. Moureu and M. Paul Kestner; United States: Dr. F. G. Cottrell and Dr. C. L. Parsons; Great Britain; Sir William Pope and Prof. H. Louis; Italy: Prof. E. Paterno and Eng. L. Parodi-Delfino; Belgium: MM. Chavanne and Crismer. M. Gérard will act as secretary to the Conference. We take this opportunity of extending to the visitors a very hearty welcome in the name of the Society of Chemical Industry, and trust that the fullest measure of success will attend their labours on behalf of chemistry and chemists in the Allied lands.

British Cotton Industry Research Association.—This association was registered last month as a company limited by guarantee (not formed for the purpose of profit) and with objects similar to those of other research associations recently instituted. The first council will consist of 25 members, 13 of whom will be appointed by the subscribers to the memorandum of association, 5 by the Federation of Master Cotton Spinners' Association, Ltd., 3 by the Cotton Spinners and Manufacturers'

Association, 2 by the Employers' Federation of Dyers and Finishers, and 2 by the Federation of Calico Printers. Pending the nomination of the council, the management will be in the hands of a committee of eighteen. The registered office is at 102, Deansgate, Manchester.

German Coal Resources and the Peace Treaty.—In an article in *Nature* (July 3), Prof. H. Louis considers the losses sustained by Germany under the terms of the Peace Treaty signed at Versailles on June 28. The cession of the basin of the Sarre will deprive Germany of 5·7 per cent. of her coal reserves and of slightly more than 7 per cent. of her annual output of bituminous coal; on the other hand France will gain to the extent of about 33 per cent. of her yearly production. Before the war the coal output in France was about 42½ million tons, of which nearly 22 million tons came from the Pas-de-Calais fields and nearly 8 millions from the Nord district. These fields have been so badly devastated that it will take at least five years to restore them. The maximum quantity of coal to be delivered by Germany to France, Italy and Luxembourg will not exceed about 32—35 million tons a year, or about one-fifth of her output exclusive of that from the Sarre basin. Added to this the defeated country may have to cede some of her Silesian coal to Poland, but in any event she will not lose more than one-third of her coal reserves; as these formerly amounted to more than half the total coal in Europe, she is not seriously weakened, although France is undoubtedly strengthened. The extent of the deposits of "minette" iron ore in Lorraine and of potash in Alsace now transferred to France is already familiar to readers of this Journal (see J., 1918, 227 R, 333 R, and 291 T).

Industrial Importance of Alsace-Lorraine.—The following comparative statistics relating to the prewar period demonstrate the potential value to France of her recovered provinces:—

Production.	France.	Alsace-Lorraine.
Coal (metric tons)	40,500,000	3,200,000
Iron ores ,,	23,250,000	21,000,000
Salt ,,	1,150,000	75,000
Mineral oil ,,	—	35,000
Iron ,,	5,310,000	3,869,000
Steel ,,	4,635,000	2,305,013
Potash salts ,,	20,000	1,167,460
Potatoes ,,	13,590,000	1,266,460
Alcohol (hectolitres)	3,100,000	11,620
Area, sq. kilom.	536,408	14,512
Population	37,000,000	1,900,000
Industrial population	6,200,000	421,000
Employees in chemical works	33,650	2,693
Railways—kilom.	50,993	1,921
Steam power (h.p.)	3,551,000	425,000
Water power (h.p.)	600,000	40,000
Blast furnaces	112	58
Coal consumption	59,000,000	11,000,000
Cotton spindles	7,400,000	1,900,000
Wool spindles	2,000,000	568,000

—(*L'Industrie Chimique, June*, 1919.)

A New Chemical Institute for Italy.—The Italian Government has allocated the sum of one million lira for the foundation of an Institute of Experimental Chemistry in the University of Padua.—(*Z. angew. Chem., May* 16, 1919.)

Radio-active Minerals in Italy.—The Italian Minister of Agriculture has appointed a commission to determine if there are sufficient radio-active materials in the country to warrant exploitation. Investigations already carried out by Professors Millosevich and Rasini, of the University of Pisa, have raised hopes of success. Madame Curie has been visiting certain localities which are believed to contain radium.—(*U.S. Com. Rep., May* 12, 1919.)

Mineral Production in Sardinia.—Before the war Sardinia exported a yearly average of 187,383 tons of metalliferous minerals, the greater part of which went to foreign countries. The most important production was that of zinc, 140,000 tons; then silver-lead, 34,000 tons; also iron ore, antimony, copper and manganese. About 28,000 tons of brown coal and anthracite was also produced. In 1915 great efforts were made to increase the mineral production, and, besides increases in the output of copper, manganese and antimony, the fuel production was augmented to 55,000 tons. In 1916 the export of iron ore to Italy reached 20,000 tons, and it is hoped that in the future 150,000 to 200,000 tons will be obtained without opening up any new mines.—(*Economista d'Italia, April* 23, 1919.)

Improvement in the Manufacture of Carbide.—A patent has recently been taken out in Sweden (by C. Aberg of Helsingfors) for the utilisation of the waste carbon monoxide produced in the manufacture of calcium carbide. It is proposed to recover and utilise this gas for the burning of the lime, thereby saving 70 per cent. of the cost of fuel. The process should not involve much expense, and experts are said to regard its possibilities with much favour.—(*Z. angew. Chem., May* 16, 1919.)

Swedish Iron Industry.—Speaking against the introduction of an 8-hour day in the Swedish iron works, engineer H. V. Eckermann stated that owing to the enormous cost of ore and fuel the cost of production of pig iron was now 230—270 kronor (£10 5*s*.—£12) per metric ton. The introduction of an 8-hour day on the top of this would lead to a most serious crisis.—(*Z. angew. Chem., June* 3, 1919.)

Cement Manufacture in Finland.—Two cement factories, in Lojos and Pargas, were started during the war. It is stated that the native raw material used is satisfactory, the cement better than that formerly imported from Germany, and that the output capacity is 1,500,000 barrels per annum. The manufacture is much hindered by shortage of coal.—(*Z. angew. Chem., June* 3, 1919.)

Chemical Works at Knarrevik, Norway.—The factories of the Norske Superfosfatfabrik were completed in 1917. The products manufactured are superphosphate and sulphuric acid, together with various by-products such as sodium fluosilicate and copper. At the factory belonging to the "A/s Knarrevik," herring-fat and meal are prepared by an extraction process. The raw materials used are refuse from the canning factories and some fresh fish, but the meal is prepared from the fresh material only. The materials used in the superphosphate factory are apatite, Florida phosphate and pyrites. The last is obtained mainly from the Orka mines; although of low grade, it is used successfully. The copper extraction works, which started operations this year, contain two roasting furnaces which consume 75 tons of burnt cinder daily. The company possesses large limestone quarries, and from the residues air-slaked lime is prepared and sold to farmers. The daily output of the limekilns is 20 tons of quicklime. The superphosphate factory is to be enlarged to a capacity of 70,000 tons.—(*Z. angew, Chem., May* 30, 1919.)

Sugar Consumption in Norway.—No sugar is produced in Norway, and as the staple diet of the people is bread, fish, meat and potatoes, the consumption of sugar has been very low compared with that of other countries. Of recent years the import duty has been lowered, and the average consumption per person has greatly increased; thus the average for 1881—1885 was 11·7 lb. per person;

1906—1910, 34·9 lb.; 1912—1915, 44·5 lb. Even these increased figures are small compared with other countries; thus in the years just before the war Sweden consumed 56·5 lb. per head, Denmark 86·7 lb., United Kingdom 89·2 lb., and the United States 82·2 lb. Until 1916 the bulk of the sugar was obtained from Germany, but since then the United States has supplied the largest quantity. When conditions again become normal it is not expected that the United States will be able to compete in the Norwegian market against Germany and the East Indies.—(*U.S. Com. Rep., June* 3, 1919.)

Coal in Celebes (Dutch East Indies).—Coal was discovered in the island in 1913, but it was of poor quality and in very thin seams. A pure and workable seam of coal 1·5 m. thick and 1200 m. long exists in the north of the Tondong Koerah district. It contains pure brown coal analysing, ash 10%, sulphur 2%, water 8%, and giving 45% of coke. Refined coal from the same district showed, ash 15%, sulphur 2—3%, water 2%, coke 60—80%, and calorific value 6000—7300 calories. The Podo coalfield is the best in the Tanette district and contains a seam 0·75 m. thick covered mostly with limestone. Analysis gave, ash 11—18%, sulphur 3%, water 1·8%, coke 60—85%, and calorific value 7400 calories. —(*Bd. of Trade J., May* 29, 1919.)

Banana Fibre as a Substitute for Hemp.—A process has been patented for the use of banana fibre for textiles, yarns, cords and alpargata soles, as a substitute for hemp. Trials having proved satisfactory, a works is to be erected in Las Palmas, and the machinery is already on order from the United States.—(*U.S. Com. Rep., April* 12, 1919.)

The Pyrites Deposits in Huelva (Spain).—A study of the deposits of pyrites in the province of Huelva reveals equally the industrial potentialities of the country and its lack of industrial enterprise, especially on the part of capital, which leaves to foreigners the easy task of enriching themselves at Spain's expense. A report published before the war showed the world's production of iron and copper pyrites in 1912 to have been 5,880,000 tons, of which 3,700,000 tons came from Spain. Ninety per cent. of the sulphur consumed in industry is used in the form of pyrites, and Spain, its chief producer, is not even mentioned in the statistics of the production of sulphuric acid. Even Holland, which produces no pyrites at all, figures fifth in the list of manufacturers of sulphuric acid with an output of 500,000 tons. During recent years Spain has decided to manufacture superphosphates, and is said to occupy the eighth place in this industry with 180,000 tons; but this quantity is insufficient for her needs and much has to be imported.—(*Dia, Mar.* 14, 1919.)

German Sugar Prospects.—The next sugar output will probably be the smallest on record, the average decrease in the area under cultivation being 15 per cent. Germany is likely to have to import sugar during the next twelve months, probably from Bohemia.—(*Frankfurter Z., May* 28, 1919.)

Platinum Deposits in Germany.—The platinum deposits discovered before the war in the Olpe and Siegen districts are now to be exploited.—(*Weltwirtschaftszeitung, June* 3, 1919.)

Cultivation of Groundnuts in Mesopotamia.—According to the *Baghdad Times*, a successful experiment has been carried out at Fellujah, on the Euphrates, about 38 miles west of Baghdad, which shows that the cultivation of groundnuts offers possibilities. A small plot one-tenth of an acre in extent yielded nuts at the rate of 2550 lb. per acre, equivalent to 1800 lb. when dried. Demonstration plots at various centres are to be arranged for as soon as possible. Up to the present Mesopotamia has been practically destitute of oil-seed crops.—(*U.S. Com. Rep., May* 13, 1919.)

German Potash for the U.S.A.—The negotiations between the Potash Syndicate and the United States have led to nothing because the latter sent, instead of technical men as representatives, officials and military persons who were not in a position to make terms. The Syndicate had sent large quantities of potash to Hamburg in the hope of effecting early business, but the American representatives advised the Syndicate to dispose of them elsewhere.—(*Z. angew. Chem., May* 27, 1919.)

American Potash in 1917.—The potash industry of the United States began in 1914 when an American company made a small production from kelp, but in 1917 there were 95 producers of potash salts and a total of 126,961 short tons of potash-bearing material was won, valued at $13,980,577. Sixty-three per cent. of this, calculated as K_2O, was made from natural brines and the bulk of the rest from cement mill dust, kelp, molasses residues and alunite. The salts mainly marketed were crude carbonate and sulphate used for agricultural purposes. Only 8100 short tons of potash (K_2O) was imported in 1917, whereas the imports for the 4 years previous to the war had been over a quarter of a million short tons per annum. America has thus become almost self-producing as regards her needs in potash salts and independent of German supplies. It is difficult to estimate how many of the smaller producers will survive when the demand no longer exceeds the available supply.

The natural potash brines consist essentially of a mixture of the sulphates, carbonates and chlorides of sodium and potassium, a comparatively small amount of chlorides being present. The brine is concentrated first by a solar evaporator and then in multiple-effect evaporators to saturation point. This is then fed through a rotary kiln drier, dried completely, and afterwards pulverised. The potash content ranges from 20—30 per cent. Several processes, most of which have not yet been used commercially, have been devised for the extraction of potash and alumina from alunite which is a basic sulphate of potash and aluminium. On ignition the potash is rendered soluble in the form of potassium sulphate and the alumina remains insoluble. Many experimental plants have been installed for the extraction of potash salts from felspar, glauconite or greensand, mill tailings, leucite, sericite and slate. A substantial amount is being produced by the treatment of waste water in beet sugar manufacture, sheep washing and the leaching of wood ashes (*cf.* this J., 1918, 264 R).—(*U.S. Geol. Surv., Mar.*, 1919.)

Wolfram in South China.—Since the fall in price at the end of 1918, shipment of wolfram from Hong Kong has practically ceased, but the extraordinary activity previous to this when production reached 1200 tons per month, shows that the South China deposits will in future be one of the chief sources of the world's supply of tungsten. A large new field was located in July, 1918, on the borders of the Kwangsi and Kwangtung Provinces. The total exports in 1918 amounted to about 10,000 metric tons, the average price at Hong Kong being about £200 per short ton. The actual cost of the ore at the mine is about £50 per ton, but coolie transport, carriage by water and rail and various taxes greatly increase this figure. There is little doubt that the mines could be worked profitably at present prices, but until the mine owners are able to frame some estimate of the post-war level of prices, little mining work is likely to be done (*cf.* this J., 1918, 13 R, 154 R, 475 R).—(*U.S. Com. Rep., April* 11, 1919.)

PARLIAMENTARY NEWS.

HOUSE OF COMMONS.

Munitions Supply during the War.

During the debate in Committee of Supply on the vote for the Ministry of Munitions, the Deputy-Minister of Munitions (Mr. Kellaway) stated that the total pre-war output of shells was about 55,000 per annum; between August 1914 and November 11, 1918, the total production was 200,000,000. The total production of guns in the same period was 26,430, plus 9170 which were repaired, and of machine guns, 250,000. The output of motor vehicles was 1910 in the September quarter of 1916, and the total output from that date to December 1918 was 100,626. At the outbreak of war, the British army possessed about 100 aeroplanes; in November 1911 the production was 4000 per month. In the ten months of 1918, 15,500 tons of lethal gases was sent to France. Although we did not succeed in improving on the effectiveness of the gases used by the Germans, we certainly equalled it, and as regards defence, our gas mask was the best of any used by the fighting forces. The saving which accrued from introducing a system of cost accounting, and basing upon these costs the prices which contractors were allowed to charge, was £300,000,000. The sale of surplus stores had realised £130,000,000 up to date.

We started the war with German fuses for our shells, with German sights for our guns, with German magnetos and plugs for our motor transport and aircraft, with German sulphuric acid and toluol for our high explosives, with German optical glass for our binoculars, with German electric bulbs for our ships, with German high-speed steel for our machine tools, and with German spelter for gun metals and other alloys. Thanks to British chemists, scientists, manufacturers and craftsmen, we have been able during the war to make ourselves independent of and superior to Germany in the production of every one of these essential materials.

Mr. Bigland referred to the action taken by the Minister of Munitions in acquiring glycerin from producers in England for the period of the war at £59 for the crude and £87 per ton for the dynamite quality. The price in the world's markets rose in some cases from £120 to £200 per ton. The Minister had, further, induced all British suppliers of oil seeds and nuts to refuse sales to buyers outside the Empire unless they contracted to deliver the glycerin-content at the British Government's price. The Norwegian and other fishermen also complied with the Government's demands, and in 1916 no fewer than 100,000 barrels of whale oil, with a glycerin-content of 10 per cent., was received from them.—(June 24.)

The Government's Trade Policy.

Sir A. Geddes, President of the Board of Trade, stated that the Government had worked out in detail a permanent trade policy which, in his opinion, should not be disclosed until conditions became more normal.—(June 24.)

Importation of American Coal.

In reply to Sir Henry Norman, Mr. Bridgeman said that contracts have been made for delivery of American coal to European ports at prices which, owing to the higher rate of freight from America, are higher than those at which British coal can be supplied. There is no restriction on the importation of coal, but American coal could only be delivered in this country at a very much higher price than that at which British coal is now obtainable.—(June 25.)

British Cellulose Company.

In answer to a question put by Mr. Raper, Mr. Bonar Law stated that it is hoped that the report of Lord Sumner's Committee regarding the British Cellulose & Chemical Manufacturing Co. will be issued before the end of July.—(July 1.)

Sulphuric Acid.

Sir A. Geddes, replying to Sir R. Cooper, gave the following approximate figures of production of sulphuric acid (100 per cent.) in the United Kingdom: 1913, 1,000,000 tons; 1918, 1,290,000 tons. The first figure includes 25,000 tons and the second 310,000 tons of fuming acid.—(July 1.)

Ministry of Ways and Communications.

In the debate on the Report stage of this Bill, Mr. Joynson Hicks proposed to remove from the scope of the Bill all provisions relating to matters other than railways and canals. Under the terms of an arrangement between the Government and a group of members, docks, harbours and roads were to be excluded, but the Ministry concerned could require improvements to be made in docks and harbours, subject to an appeal by the dock authorities to an arbitrator; and a special Roads Advisory Committee was to be constituted to advise the Ministry. Both proposals were carried.—(July 1.)

Income Tax (Learned Societies).

Asked by Mr. Marriott if he would introduce legislation to place learned societies in the same position in regard to income tax as societies registered under the Industrial and Provident Societies Act, 1893, Mr. Chamberlain referred to the exemption contained in Section 37 of the Income Tax Act, 1918, in favour of charitable societies, which includes societies for the promotion of science or other branches of learning.—(July 2.)

Levinstein, Ltd.

Replying to Mr. Macquisten on the subject of the acquisition by Levinstein, Ltd. of the Ellesmore Port Chemical Works, formerly belonging to Meister, Lucius and Brüning, and of the supposed manufacturing secrets in its possession and their sale to the Du Pont Powder Co., of America, Sir A. Geddes said that the works in question was sold for, approximately, £79,000 to a British-controlled company of which Dr. H. Levinstein, a British-born subject, is managing director. No secret processes for the manufacture of dyes were discovered there. The details of the agreement made between Levinstein, Ltd., and the Du Pont Co. are known to the Board of Trade, but would not be disclosed without the consent of the parties concerned. Dr. Levinstein and his company have rendered very great services to H.M. Government and to British dye-users during the war.—(July 2.)

Scientific Attaché.

Mr. Harmsworth informed Commander Bellairs that Major Mendenhall, professor of physics in the University of Wisconsin, has been appointed scientific attaché to the United States Embassy in this country; but no steps have been taken to make a similar appointment to the British Embassy at Washington.—(July 8.)

Price of Coal.

Sir A. Geddes announced the Government's intention to raise the price of coal by 6*s*. a ton in order to meet the increased expenses at the mines. The effects will probably be very serious.—(July 9.)

LEGAL INTELLIGENCE.

CLAIM TO DISSOLVE CONTRACTS WITH AN ENEMY FIRM *The British Diamalt Co. v. H. A. Taylor and Others.*

In the King's Bench Division on June 20, Mr. Justice Bailhache heard an action by H. A. Taylor, D. D. Taylor, H. D. Taylor and C. T. Taylor, trading as the British Diamalt Co., manufacturers of malt foods and extracts at Sawbridge, North Herts, against J. Hauser, M. Sabotka, H. Hauser, A. Hauser, H. Sabotka and F. Sabotka, trading as the Erste Wiener Export Malzfabrik Hauser and Sabotka, manufacturers of patented and proprietary malt foods and extracts at Vienna, for a declaration that certain contracts dated 1906, 1910 and 1913 were dissolved as from the date of the outbreak of war between Great Britain and Austria.

According to plaintiffs, the agreements provided that they should use certain of the Austrian company's trade marks and processes and any developments thereof for the production from wheat and malt of malt-extract preparations. During the war the plaintiffs had effected improvements in the processes and discovered certain preparations, which under the contract they could not have utilised or manufactured without the written consent of the defendants; but the obtaining of such consent would have involved intercourse with the enemy.

Counsel for the defendants maintained that they were entitled to rights which had accrued up to the date of the outbreak of war. The agreement should be either dissolved in its entirety or not at all.

His Lordship said he was satisfied that these contracts were, for certain purposes, dissolved, and he would make the declaration claimed, provided it could be put into proper form. At the same time the declaration would be without prejudice to any rights of the defendants at the date of war; and with liberty to apply if any question arises as to what those rights were. The question of costs was reserved.

PROHIBITION OF EXPORT OF PRUSSIATE OF SODA. *Klipstein and Co. v. The Manchester Oxide Co., Ltd.*

In the King's Bench Division on June 27, Messrs. Klipstein and Co., of New York, sought to recover damages from the Manchester Oxide Co., Ltd., for breach of a contract, dated July 10, 1914, for the supply of 600 tons of yellow prussiate of soda. The contract price was $2\frac{3}{4}d.$ per lb., delivery in equal and monthly quantities over 1915. The main defence was that delivery was prevented owing to prohibition of export to the United States being proclaimed in March 1915. The plaintiff company replied that it was entitled to delivery in Canada, and had instructed defendant company to that effect in March 1915.

Mr. Justice Bailhache delivered judgment on June 30. He said that defendant company was the only substantial manufacturer of prussiate of soda in this country, and that by the contract practically the entire output—about 50 tons per week—would have been shipped to America. In the autumn of 1914, a Mr. Chance and his company, manufacturers of cyanide for the S. African mines, offered to buy defendants' output at $4d.$ per lb., as against the market price of $6\frac{1}{2}d.$, in the event of the Board of Trade issuing a prohibition of export. That prohibition was eventually issued after the Board had made its own independent inquiries; the proclamation was a valid one to which the defendants had to conform although it was greatly to their interest to do so. The request to ship to Montreal was not a business request which was intended to be acted upon, and he was not sure that such shipment would have been justifiable in view of the contingency that the material might have found its way to the United States.

The defence succeeded except as to the failure to ship the consignment for January 1915. Judgment would be for the plaintiff company for £1750 with costs.

APPLICATION FOR USE OF BAEKELAND PATENTS.

Before Sir Cornelius Dalton in the Patents Court on June 26 an application was made by Nicholsons (Newcastle-on-Tyne) Ltd., for licences in respect of certain of the well-known Baekeland chemical patents proposed to be used for making varnishes. The application related to Nos. 1921/1908, 1922/1908, 21,566/1908, 6293/1912, and 6294/1912. The applicants had been making aeroplanes and the standard dope during the war, and had a big plant which would be admirably suited for making materials such as were covered by the patents in question, *viz.*, condensation products of phenols and formaldehyde.

Sir George Marks, for the patentees, said he could not see that there was any evidence that the applicants were carrying on a business for which these patents were essential or that they were familiar with these patents. He suggested that the licences should not be granted until further evidence had been put forward. British Dyes Ltd. was concerned in these patents.

The Controller thought it premature at the present stage to grant the licences, and while not refusing the application, he adjourned it for further evidence. An order was made accordingly.

REPORTS.

POWER ALCOHOL.

REPORT OF THE INTER-DEPARTMENTAL COMMITTEE ON VARIOUS MATTERS CONCERNING THE PRODUCTION AND UTILISATION OF ALCOHOL FOR POWER AND TRACTION PURPOSES. H.M. Petroleum Executive. [Cmd. 218, *2d.*] London: H.M. Stationery Office.

The above report has been presented to the Minister in charge of the Petroleum Executive by the special committee appointed in October, 1918, which included, among others, the late Sir Boverton Redwood, Bt. (chairman), Sir J. J. Dobbie, Prof. H. B. Dixon, and Dr. W. R. Ormandy.

The matters especially considered were (1) the production of alcohol from (*a*) waste sulphite lyes, (*b*) wood, (*c*) peat, (*d*) bracken etc., (*e*) the mahua and other trees, (*f*) potatoes, maize, beet, molasses and other alimentary substances, (*g*) seaweeds, and (*h*) by synthesis; (2) the utilisation of alcohol in internal combustion engines either alone, using adaptations of, or special devices on, existing engines, or admixed with other substances; and (3) denaturants and Excise arrangements.

Owing to the cessation of hostilities the Committee deemed it advisable to prepare this progress report, recording conclusions and recommendations the adoption of which they consider to be necessary if alcohol and mixtures of alcohol with ether or with hydrocarbons are to be brought into use for generating power.

The Departmental Committee on "Industrial Alcohol" reported in 1905 that the use of spirit for motors depended upon price, and that as the price of petrol was then about half that of methylated spirit further investigation might be delayed until the approximation between the two prices created a practical alternative of choice between the two fuels. It is clear that the conditions fulfilling this anticipation are in sight.

As the words "industrial alcohol" have been

taken by some to refer to an inferior potable spirit, it is recommended that all alcohol for power or traction purposes should be described as "power alcohol." All sales of power alcohol should be made on the basis of a certified percentage by volume of absolute ethyl alcohol with a minimum of 90% at 62° F.; alcohol mixtures should not contain water in excess of 10% by volume of the alcohol after mixture, and when benzol, ether, petrol or the like are mixed with alcohol in quantities in excess of those which may be required as partial denaturants, the nature and percentage of such components should be plainly stated on the containers, etc.

It is probable that in the near future the demand for petrol will cause the price to rise, indeed in America the sale price rose 200% between 1914 and 1918 when the consumption rose from 1200 to 2680 million gallons, and the investigation of alternative supplies of motor fuel should now proceed. Prof. Dixon is directing the compilation of experimental data concerning the behaviour of alcohol, alcohol-benzol, alcohol-ether and other alcohol-mixture vapours on their combustion with different volumes of air and with varying quantities of water and denaturants. A practical trial of alcohol-benzol and alcohol-benzol-petrol mixtures is being carried out in one complete fleet of motor omnibuses over a period of 26 weeks, together with incidental bench and other tests.

Records of work done on the extraction of ethylene from coal and coke-oven gases indicate that there is available a large potential source of power alcohol, but further investigations are necessary, particularly upon the conversion of ethylene into alcohol before definite figures as to quantities and price can be given.

The fundamental attraction of alcohol as a substitute for any fuel necessarily derived from coal or oil lies in the fact that its chief sources, which are to be found in the vegetable world, are being continuously renewed and are susceptible of great expansion without encroachment upon food supplies. Important vegetable substances from which power alcohol may be obtained are: (1) Sugar-containing products, such as molasses, mahua flowers, sugar beet, and mangolds; (2) starch or inulin-containing products, such as maize and other cereals, potatoes and artichokes; and (3) cellulose-containing products, such as peat, sulphite wood pulp lyes and wood. The world's production of molasses is not known, as large quantities are run to waste. Evidence was received concerning achieved costs and yields of power alcohol from the flowers of the mahua tree (*Bassia latifolia*), which flourishes in Hyderabad and the Central Provinces of India. The sun-dried flowers contain about 60% by weight of fermentable sugar and can be collected and delivered to the factory in the zone of growth at £1 10*s*. per ton. The yield on fermentation and distillation is about 90 gallons of 95% alcohol per ton. The flowers can be pressed, packed, exported and stored for long periods without deterioration. It may be possible to increase the production of flowers by cultural treatment, but so far cultivation of the mahua tree has not been attempted.

The prospective production of alcohol from maize and other cereals in various parts of the Empire is considered encouraging both as regards quantities and cost, but the production within the United Kingdom from potatoes, artichokes, sugar beet and mangolds cannot be placed on a commercial basis without some system of State subvention. Potatoes yield only 20 gallons of 95% alcohol per ton and artichokes little more. No satisfactory method for the utilisation of peat as a source of alcohol has been brought to notice, but its potential value should not be overlooked. The Committee considers that so far as vegetable sources of raw material are concerned we must rely mainly on increased production in tropical and sub-tropical countries.

It appears that as regards the United Kingdom new conditions affecting the denaturing of alcohol would arise if the market price of petrol were to remain permanently as high as that of denatured power alcohol. The high price of alcohol compared with petrol has prevented its commercial use for power purposes hitherto, and since the denaturing process now in use increases the cost (sometimes by as much as 6*d*. per gall.) the increase should be restricted by reducing the proportion of wood naphtha. In all cases of approved use for power purposes the proportion of wood naphtha might be substantially diminished or replaced by petrol, benzol, or other nauseous substance supplemented by methyl violet as colouring. It is recommended that every effort be made to provide a denaturant or alternative denaturants—*e.g.* formaldehyde, pyridine and tobacco oil, the employment of which will be effective in the smallest possible quantities and at the lowest possible cost. When denaturing operations are carried out at any transport depôt, the necessary volumetric mixings should be allowed in any suitable vessel although such vessel may contain power alcohol previously denatured. No impediment should be placed in the way of manufacturers or importers by the imposition of the usual bonded warehouse rules and regulations upon those who store and handle alcohol denatured to an approved specification, although special rules will have to be observed. The motor omnibus trial proved the desirability of users being allowed to convey power alcohol by rail or road in tank wagons and the use of an approved type should be allowed, under seal if the alcohol be undenatured.

It is recommended that having regard to the exemption of home-produced benzol and shale motor spirit from the motor-spirit tax (Excise), power alcohol when produced in the United Kingdom be correspondingly exempted, and that, having regard to the scope for earlier large production in the Empire overseas, importation of power alcohol be permitted free of duty.

It is considered that the State should foster the production and utilisation of alcohol for power purposes because, as has already been indicated, the chief raw materials for its production are susceptible of great expansion, while the materials from which benzol, petrol, etc. are derived are limited to deposits, definite in extent, that cannot be renewed. Furthermore as power alcohol is miscible with water in all proportions its use affords greater safety from fire.

The development of the alcohol industry is such a complex and far-reaching problem that it cannot be left entirely to the chances of private enterprise and the ordinary play of economic forces, but can only be handled adequately by concerted Government action. Consideration should be given to the education of the public concerning the merits of power alcohol and mixtures of that fuel.

An organisation should be established by the Government to initiate and supervise experimental and practical development work at home and overseas on the production and utilisation of power alcohol, and to report from time to time for public information on all scientific, technical, and economic problems connected therewith. This organisation should be permanent, be in close relation with the various Governments of the Empire, and be so constituted as to be able to deal with alcohol in conjunction with other fuels which are or may become available as a source of power.

Further investigations should include an examination into the necessity for revision of the statu-

tory regulations that the specific gravity of distillers' wort before fermentation must be ascertained by means of the saccharometer. It is equally essential that the necessity to allow fermentation and distillation to proceed simultaneously in the same building and to allow continuous distillation should receive early consideration.

REPORT OF THE FOOD INVESTIGATION BOARD FOR THE YEAR 1918. Department of Scientific and Industrial Research. (H.M. Stationery Office. 1919.) 3*d*. net.

The Board was first established as the Cold Storage Research Board but, owing to the wide scope of the work involved, the Advisory Council changed the title to the "Food Investigation Board" with the following terms of reference. "To organise and control research into the preparation and preservation of food." To cover so large a field as is offered by food, the Board decided to establish committees corresponding with the different classes of material dealt with, and an account of the investigations in progress is described conveniently by recording the work of each committee.

The Fish Preservation Committee has been occupied mainly with the investigation of a method known as brine freezing, in which the fish to be frozen are immersed in strong brine at 10° F. (−12° C.); this process is rapid and the separation of fluid and solid in the tissues which occurs during slow freezing is prevented. It seems possible that the wastage of food due to gluts of fish could be avoided by the installation of brine-freezing plants at suitable ports. Although the workers are at present widely scattered in different research laboratories, much preliminary work has been done; plans and estimates for the establishment of a permanent laboratory at Lowestoft are now being prepared. The work of the Engineering Committee has been concentrated, for the time being, on the problems presented by the development of cold storage in this country, namely, the type of wagon or barge best suited for the carriage of frozen produce, and upon problems of insulation. The Meat Committee has a large number of investigations in hand, including an inquiry into the cause of the peculiar sensitiveness of beef to freezing. A special experimental plant for investigations at low temperatures has been installed at University College, London. Other investigations in progress relate to the autolytic changes in meat, influence of blood on the rate of autolysis, isolation of hitherto unknown flesh constituents, moulds which infect cold stores, etc.

The Oils and Fats Committee was formed to make a survey of the sources of supply of edible oils and fats with the object of increasing the proportion available for human consumption. Research under the Fruit and Vegetable Committee is in progress at Cambridge and in London. The influence of the composition of the air in fruit stores is under investigation and interesting results in stopping the sprouting of store potatoes have been obtained. The oxidising enzymes which are responsible for the browning of the flesh of ripe fruit have been studied and new knowledge regarding the distribution of these oxidases has been secured. It is proposed to follow out the chemical changes occurring in fruit during maturation and storage, and methods have been devised for obtaining satisfactory samples of sap and for preserving it. The nitrogen content of apple sap was found to be extremely low, namely, 0·014 grm. per 100 c.c.; of this nitrogen, 40 per cent. was present as ammonium salts and the remainder as simple amino acids, whilst proteins could not be detected. Determinations of the quantities of starch, sucrose, and reducing sugars (maltose, dextrose, lævulose, pentoses) are being made in order to follow the changes taking place in the carbohydrates of fruit. The physical changes progressively occurring in stored apples will be studied by determining the depression of the freezing point, density, viscosity, electrical conductivity, and concentration of hydrogen ions of the expressed juice at regular intervals. An examination of the effect of external conditions on the growth of fungi producing the decay of stored fruit is proceeding. The various fungi are being isolated and the effect of low temperature and various concentrations of carbon dioxide on their germination and growth is being studied.

THE ASSOCIATION OF BRITISH CHEMICAL MANUFACTURERS.

The annual report for the year ending May 31, 1919, states that 145 firms, representing a capital of £70,000,000, are now members of the Association, and, in addition, seven other separate associations are affiliated thereto. The Association has appointed representatives on the committee set up by the Board of Trade for the purpose of reviewing and co-ordinating the needs of consumers and the producing powers of British manufacturers in the matter of dyes; and the claims of the fine chemical industry to be regarded as a key industry have been pressed upon the Board. Although the Government policy with regard to key industries will not be announced until the autumn, the Council welcomes the work of the Imports Restriction Committee upon which the Association is represented.

The Traffic Committee has considered various matters connected with railway and road transport of chemicals, and the Association has joined the Traders' Traffic Conference. In December the Association was invited by the then Minister of Reconstruction to advise on the utilisation of national factories after the war. The sub-committee appointed to consider this question recommended in April that the sale of national factories should be delayed for six months. A good response has attended the request to producers of pitch to supply to the Association particulars of all sales over 100 tons. Particulars of such sales (other than vendor's name) are now being supplied to other producers. At the request of the corporation which was formed by British buyers of quinine to enter into an agreement to purchase quinine from the Dutch manufacturers, the General Manager was appointed chairman of the corporation. An information and statistical bureau has been established and a directory will shortly be available which should assist British chemical manufacturers in extending their home and overseas trade. A memorandum suggesting amendments of the Patents and Designs Act Bill (1917) has been presented by the Association to the Comptroller-General of Patents.

The Chairman of the Association, Mr. R. G. Perry, has been appointed to act as arbitrator in disputes arising out of transactions in or relating to the chemical industry. Collaboration as occasion arises between the Paris Chamber of Commerce and the Association has been arranged for. A memorandum on the question of fuel shortage was presented to the Coal Controller. A National Sulphuric Acid Association to co-operate very closely with the Association has been established during the year. The Association has discussed with the Board of Trade the inadequacy of its published statistics, and it is hoped that import statistics of various chemicals will be available to its members even when not included in the published official returns. During the past year the

closest co-operation has been maintained with the Department of Overseas Trade. The Association has decided to support attempts being made to remove unfairness in the imposition of levies under the Munitions (Liability for Explosions) Act, 1916.

COMPANY NEWS.

ZINC CORPORATION, LTD.

At the eighth ordinary general meeting, held in London on June 23, Mr. F. A. Govett, chairman, reported upon the position of the company and reviewed the general industrial situation. The net profits of the Corporation for 1918 amounted to £226,470, compared with £225,150 for 1917, and the dividends for the year 6*s.* and 3*s.*, as against 5*s.* and 2*s.*, on the preference and ordinary shares, respectively. The ore reserves at the end of 1918, exclusive of the zinc lode, were estimated at 2,076,000 tons with an average value of 14·6 per cent. lead, 2·6 oz. silver, and 9·4 per cent. zinc, or 189,000 tons more than at the end of the previous year. The company has £100,000 invested in the Tasmanian Electrolytic Co., which is contemplating an extension of plant to increase its daily output of electrolytic zinc to 100 tons; it has a two-fifths interest in the large company which has been formed to work the Elmore process, and it is erecting a small plant on a commercial scale; it has also a share in the Ganelin process which is under trial by the Amalgamated Zinc Co.

The general outlook is not good; there are very large stocks of base metals and the actual consumption is small. The Australian industry will survive provided European labour conditions are reasonably quiet. The recent fall in the price of lead has curtailed sharply production in America, Spain and other countries, and although prices may not as yet have touched bottom there is no probability that they will fall below the company's cost of production. At the present time stocks of metal are accumulating, sales are very few; and the company's working expenses are at the rate of £35,000 per month. The present position is such as the world has never seen before, and the future is hopelessly obscure.

Appreciable rise in the cost of coal and labour would seem to be the final nail in the coffin of zinc smelting in this country, as witness the recent stoppage of work at Avonmouth. The amount of protection required by this key industry makes it impossible to establish it here. Such establishment is now, moreover, undesirable; there is no great profit in it; the submarine has altered the whole aspect of the problem for it requires more ships and longer voyages to bring concentrates than to import the metal. In war time we must be dependent on the importation of one or the other, and in peace it may pay us, as formerly, much better to import the spelter from countries where labour is cheaper and more productive. Unless labour conditions here are going to alter vastly, or unless the price of spelter is to be permanently far higher than before the war, there is no further question of the company joining in any scheme of zinc production in this country. Increased costs of production point to electrolytic extraction by cheap water power as the only solution. In the immediate future it looks as if spelter production will go back to Belgium, and that it will then be gradually transferred from there to Norway, as water power becomes harnessed.

Lever Brothers, Ltd.—At an extraordinary meeting held on June 26, it was resolved to increase the capital of the company from £60,000,000 to £100,000,000.

NATAL AMMONIUM, LTD.

The sixth annual general meeting was held in London on June 25. The Rt. Hon. the Earl of Selborne, who presided, said that the company's output of sulphate of ammonia increased by 60 per cent. during 1918. The material is of a high quality and finds a ready sale at high prices, 10 per cent. of the production being absorbed by the South African market and the remainder being exported mainly to Mauritius and the East. The full-gauge railway to neighbouring coalfields has now been completed. Of the ten additional producers, to be constructed of materials obtained locally, two are completely and two nearly finished. The net profit on the year's working was £18,529 (capital £325,000, and this has been set against the loss of £22,813 brought forward from the previous year. The property is a really valuable one, but the company is saddled with a war load of debt, unsecured loans amounting to £110,000 having been contracted. The chairman also stated that the stocks of sulphate of ammonia valued in the balance sheet at £44,000 were taken in at £40 a ton, and that all of it has since been realised at prices above £40 and up to £47 a ton.

NORTHERN EXPLORATION CO., LTD.

The ordinary general meeting was held on June 26, in London. The chairman of the company, Mr. F. L. Davis, presided and described in some detail the estimated mineral resources of the islands (this J., 1918, 239 R) and the efforts made to exploit them.

The output of coal in 1918 was over 100,000 tons, and working is so simple that even now, with limited appliances, the cost does not exceed 7*s.* per ton f.o.b. Spitsbergen. A Swedish and a Norwegian company are also successfully working coal seams. The extensive iron ore deposits can be quarried at under 3*s.* a ton and as there is an abundance of good limestone at hand, there should in time develop an important steel industry. A good quality asbestos occurs at Recherche Bay, and the marble deposits are of exceptional value. Conservative estimates put the cost of delivery of the marble in this country at £2 per ton, and the value here at £4—£16 per ton. Since 1914, 300,000—400,000 tons of coal has been shipped to Scandinavia and over £1,000,000 has been spent by Scandinavian companies which have nearly completed equipment to produce 1,500,000—2,000,000 tons of coal per annum.

LAUTARO NITRATE.

As the company's three oficinas were overhauled during 1918, the production was about 300,000 quintals less than in the previous year. The trading profit was consequently somewhat lower at £317,064. The gross profit, £399,835, included £10,262 from general investments and £72,000 from investments in steamers. After deducting income tax and excess profits duty, etc., there remains a net profit of £248.603 (capital £550,000). The dividend for the year is 18 per cent. free of tax, and large appropriations have been made to reserves. The company has £197,807 invested in steamers (all the original steamers were lost by enemy action), and £24,842 in enemy banks, derived from sale of nitrate stocks in Hamburg at the outbreak of war.

In his address to the thirty-first annual meeting on June 18, the chairman urged two reforms: the Chilean Government should reduce the export duty on nitrate, or better, it should revoke that duty and participate in the sale or in the profits of the producers; and a really effective central selling agency should be established.

SAN SEBASTIAN NITRATE.

The production of nitrate during 1918 was 289,284 quintals, of which 68,546 quintals, valued at £28,496, was in hand at the end of December. The gross profit was £2516 higher at £12,935, and the net profit £7726 as against £7012 (issued capital £143,750). The dividend is again passed. Addressing the annual meeting held on June 19, the chairman refuted the official view that as nitrate cannot be used on the land until early next year, therefore there is no need to ship it now. Neither the works, railways, nor ports in Chile are designed to meet a sudden demand, and transport facilities in Europe are not such as to allow of a postponement of delivery until actual consumption is due. The company's works have been closed down since January last.

TRADE NOTES.

BRITISH.

Canadian Tariff Changes.—In the annual Budget speech on June 5, the Minister of Finance, Sir Thomas White, announced some important changes in the tariff regulations regarding chemicals and metals. These are referred to on page R of this issue, and the full list is given in the *Board of Trade Journal* of July 3. The Government announces that changes made this year are of a temporary nature, and has requested the various industries of the Dominion working together in groups to prepare exhaustive statements in support of any action they wish the Government to take at any later date.

South African Wattle Bark.—The Report of the Acting Trade Commissioner for the South African Union in London, dated March 18 last, gives the following figures of consumption and stocks in hand:

Consumption.	1917. tons.	1918. tons.
Bark and liquid extract converted into terms of bark	24,267	27,526
Solid extract	745	1,814
Stocks held at December 31.		
Bark and liquid extract in terms of bark	6,486	13,508
Solid extract	286	1,051

—(*S. Afr. J. Ind., May*, 1919.)

The Australian Portland Cement Market.—Most of the cement used in Australia is imported from Britain, Japan and Denmark, although recently a good-quality cement has been produced in Australia to meet the difficulties attending importation. The total quantity imported in 1915-16 amounted to 75,843 tons, of which the United Kingdom supplied about 33%, Hong Kong 10%, New Zealand 9%, Denmark 16%, and Japan 18%. During the same year 1367 tons was exported to the Pacific Islands. The general import duty on cement is 1*s.* 6*d.* per cwt., with a preferential tariff of 1*s.* per cwt. on cement produced in the United Kingdom.—(*U.S. Com. Rep., June* 31, 1919.)

FOREIGN.

Chemical Imports into the United States.—A bulletin entitled "Chemical and Allied Products Used in the United States" (Miscellaneous Series, No. 82) has just been issued by the Bureau of Foreign and Domestic Commerce, Department of Commerce, with the co-operation of the American Chemical Society. The object of the publication is to reveal to manufacturers the extent of the domestic markets for the various chemical wares the manufacture of which has recently been undertaken in the United States, and those firms who are obtaining German patents from the Chemical Foundation expect to find in the statistics the facts they need to plan their operations intelligently. It is shown, *inter alia*, that of the $45,000,000 worth of manufactured chemicals, exclusive of dyes, paints, pigments and varnishes, imported in the year 1913—1914, more than 40 per cent. came from Germany. The bulk of the publication consists of classified lists of some 2500 materials by quantity and by value, together with the percentage derived from each country of origin. Commercial names are given in the first place and these are followed in some cases by the scientific names or by very brief descriptions. Following this is a list of 3000 other products imported in amounts less than $100 each. Summary tables comparing imports with exports and production are also included. The price of the bulletin is 25 cents, and it may be obtained from the Superintendent of Documents, Washington, D.C.—(*U.S. Com. Rep., May* 26, 1919.)

The German Nitrogen Syndicate.—On May 8 the "Stickstoff-Syndicat G.m.b.H." (Nitrogen Syndicate, Ltd.) was formed by the three great groups of producers of nitrogen compounds with the object of effecting combined sales of their products. The groups in question are the Badische Anilin u. Sodafabrik (works at Oppau and Bruna near Merseburg); the Ammoniak - Verkaufs - Vereinigung (Ammonia Sales Association) in Bochum, with the Oberschlesische Kokswerke u. Chemische Fabriken A.-G. (Upper Silesian Coke and Chemical Works, Ltd.) and the Wirtschaftliche Vereinigung der Gaswerke (Economic Association of Gas Works); and the Bayrische Stickstoff-Werke (Bavarian Nitrogen Works), representing the cyanamide industry.—(*Z. angew. Chem., June* 3, 1919.)

Ban on German Goods in Denmark.—The Copenhagen papers publish detailed lists of goods of which the importation from Germany to Denmark has been forbidden by the Entente. The list includes gold, silver, war material of all kinds, coal, coke, wood, paper, dyes, iron and steel, sugar, window glass, and machinery for industrial purposes. The Danish Foreign Office is to protest against this procedure, pointing out that it will have more serious consequences for Denmark than for Germany against which country the prohibition is directed.—(*Z. angew. Chem., May* 17, 1919.)

Reports of German Dye Companies for 1918.—The Badische Anilin u. Sodafabrik had a gross profit of 67,646,537 marks, general expenses 15,365,924 mk., and net profit 10,848,442 mk. (after writing off 40,604,423 mk.); the corresponding figures for 1917 were 58,245,342 mk., 7,973,036 mk., and 30,001,400 mk., respectively. Over 60 million marks was paid in wages, and nearly 22 millions in salaries and bonuses. The dividend for the year is 12 per cent., compared with 20 per cent. for 1917; 5 million mk. is placed to reserve, 2 million mk. to a fund for disabled soldiers and 1 million mk. for the workmen's relief fund.

After the signing of the armistice, many of the factories were closed down, and by the end of November the remaining factories at Ludwigshafen and Oppau also ceased operations. A few of the factories at Ludwigshafen have since resumed work. It is hoped that the factory at Oppau will be working at full pressure by the end of 1919, and the factory at Merseburg, which is being extended, by the beginning of 1921. In March 1919, a new loan of 50 million mk. at 96½ per cent. was contracted for the purpose of extending the nitrogen works and for the purchase of lignite mines.

The Höchst Dye Works (formerly Meister, Lucius and Brüning) reports a gross profit of 52,800,954 mk., and, after writing off 23,750,000 mk., a net

profit of 14,955,604 mk. The dividend has been reduced from 18 to 12 per cent. A loan of 30 million mk. is being raised to purchase a new plant and to reconstruct for peace trade.

The A.-G. für Anilin-Fabrikation, Berlin, has also reduced its dividend from 18 to 12 per cent. Its net profit, including carrying forward, was 4,972,770 mk. The expenditure on wages, salaries, and bonuses was nearly 9 million mk. higher than in 1917. The results for the first quarter of 1919 are very unsatisfactory.

The report of the Chemische Fabriken vorm. Weiler-ter-Meer, of Uerdingen, Lower Rhine, states that all departments of the works were closed down after the Allied occupation. The net profit and balance brought forward amount to £62,000, against £107,000 in 1917, and the dividend is reduced from 12 to 10 per cent.

The Griesheim-Elektron Company of Frankfurt a/Main made a net profit of 4,516,197 mk. (9,656,072 mk. in 1917), and declares a dividend of 7 per cent. (against 16 per cent.). The future is considered very doubtful.

The Leverkusen Dye Works (formerly Fr. Bayer and Co. in Leverkusen), reports a net profit of 13,088,188 mk. (against 31,084,370 mk. in 1917) and pays a dividend of 12 per cent. It is proposed to extend the works in the neighbourhood of Cologne. —(*Kölnische u. Frankfurter Z., Z. angew. Chem., May*, 1919.)

Italian Company News.—A company with a capital of 300,000 lire (say £12,500) has been formed in Verona to manufacture "tetraphosphate" (this J., 1918, 437 R) and other products.

The "Societa Italiana Prodotti Esplodenti" in Milan (capital 30,000,000 lire) made a net profit of 2,203,038 lire in 1918, out of which the legally sanctioned 8 per cent. dividend will be paid.

The Match Industry in Italy.—The production of matches in Italy in 1914 amounted to 72 milliards, of which 57 per cent. was of wood and 45 per cent. of wax. Of these numbers, some 5 and 13 milliards respectively were exported, chiefly to the Mediterranean countries. The value of the production is estimated at 22 million lire, of which sum 15 millions was for the wax matches. In 1911, there were upwards of 100 factories employing 5500 workpeople; they were mostly small factories, the total power used being only 1000 h.p. The three largest, with one of the smaller, have formed a "trust," which comprises 70 per cent. of the total production. Some 70 tons of white and red phosphorus were used in the manufacture. The wood for the boxes, amounting to 800 tons, was imported, for the most part from Bavaria, and consisted principally of refuse from the toy-making industry.—(*Z. angew. Chemie, March* 28, 1919.)

Photographic Chemicals in Switzerland.—The Swiss Society of Chemical Industry in Basel is about to place on the market a number of photographic chemicals of its own manufacture. In addition to "metagol," diamidophenol "Ciba," and ready-made developers, such as metagol-hydroquinone and a metagol-glycine-paramidophenol, are also to be marketed. The last-named and also a new paramidophenol-hydroquinone mixture will be sold in a highly concentrated form to be diluted 10—40 times before use. The company is also manufacturing fixing salts and a dry plate, the latter to be marked "Ciba."—(*Z. angew. Chem., May* 16, 1919.)

The Swiss Glass Bottle Industry.—A trust is being formed in this industry. Simultaneously with the institution of a six-hour day in all the factories it is proposed to introduce the Owen bottle machine, the patent rights alone of which cost 15 million francs. With this machine it is hoped to meet foreign competition, for it is much more efficient than the French machines hitherto used in Switzerland.—(*Z. angew. Chem.*, May 16, 1919.)

Swiss-German Commercial Treaty.—By the new treaty covering the period June 1 to November 30, 1919, Germany undertakes to deliver to Switzerland 50,000 tons of coal per month, at 123 and 140 francs per ton delivered at the Swiss frontier. Germany also agrees to permit exports of iron and steel so far as possible; as no fixed quantities are specified both countries will be able to make use of free competition. During the treaty period Germany will also send 250 trucks of raw sugar—to enable the Aarberg sugar factory to continue operations—and 250 trucks of potash salts per month. Switzerland has agreed to send to Germany 50 trucks of milk products per month and, conditionally, 5000 head of cattle.

OFFICIAL TRADE INTELLIGENCE.

(*From the Board of Trade Journal for June* 26 *and July* 3.)

TARIFF. CUSTOMS. EXCISE.

Australia.—The prohibition of the import of tinplate has been revoked.

Canada.—The rates of import duties have been modified on, *inter alia,* many salts of sodium, crude petroleum, cement, iron ore, lead, tin, zinc, copper, brass, nickel, nickel silver and rolled iron.

China.—The revised Customs tariff will be enforced from August 1.

Czecho-Slovakia.—Export licences for goods to be exported to all destinations will be granted by the Import and Export Commission, Prague, subject to the condition that payments for such goods have been made through the Czecho-Slovak Clearing Bank, Prague.

France.—A translation* of the "Bill for the Modification of the Customs Régime of Petroleum Products Imported into France" is given in the *Bd. of Trade J.* of July 3.

Greece.—The Greek Government has given notice of denunciation of several commercial conventions with the U.K. Failing 3 months' final notice, these will remain in force until September 3, 1920.

The consumption tax on imported alcohol has been increased, except in certain cases, with effect as from April 1—14. This tax is charged in addition to the ordinary import duty.

Johore.—The export duties have been revised on areca nuts, gambier, sugar, indigo, rubber latex, timber, gold, tin, tin ore, wolfram and scheelite, etc.

Netherlands East Indies.—Export licences are still required for kinabark, quinine and its salts, tin, tin ore, copra, groundnuts and mineral oils.

Newfoundland.—It is proposed to raise the rate of import duty on certain kinds of leather, when bark tanned, from 20 to 30 per cent. *ad valorem.*

Spain.—The temporary suspension of the export duty on lead ores has been prolonged until August 31 next.

United States.—The War Trade Board will consider applications for import licences for pig tin and alloys containing tin as from June 16, but shipments must not leave place of origin before June 30 or enter the United States before August 1.

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 73, Basinghall Street, London, E.C. 2. from firms, agents or individuals who desire to represent U.K. manufacturers or exporters of the goods specified, or in certain cases to buy goods on own account. British firms may obtain the names and addresses of the persons referred to by applying to the department and quoting the specific reference number.

Locality of Firm or Agent	Materials	Reference Number
Australia ...	Dyes for leather, woollen goods and hat straw ...	3
,, ...	Gelatin, safety matches	4
,, ...	Sheet glass and glassware	5
,, ...	Whale oil, cod oil, turpentine, industrial chemicals	10
British India ...	Dry distemper paint, belt composition	1205
,, ...	Leather, steel	1208
,, ...	Chemicals, pharmaceutical requisites	1215
,, ...	Heavy chemicals ...	1218
,, ...	Dyes, lubricants, greases	15
,, ...	Printing paper, fast dyes for cotton thread, oils, glass, cement ...	18
,, ...	Aniline dyes	20, 28
,, ...	Chemicals, paper ...	22
,, ...	Lubricating oils, greases, motals, boiler composition, cement, paints, disinfectants	24
,, ...	Earthenware, glassware	29
British W. Indies	Drugs, druggists' sundries	1221
,,	Fertilisers, cane sugar, molasses	33
Canada	Filter papers (13-15 in. diam.)	*
South Africa ...	Mining chemicals, dyes, paints, etc.	1230
Belgium ...	Ultramarine, white lead, linseed oil, tanning and dyeing extracts ...	1240
,, ...	Soft pig lead, antimony	1242
,, ...	Rubber, oils, greases ...	52
,, ...	Gas mantles	57
,, ...	Industriol oils	58
,, ...	Chemical and pharmaceutical products ...	60
Bulgaria ...	Paper, leather, gum arabic, tin, lead, antimony, petroleum, alcohol, turpentine, printing inks, dyes, paints, soda	1245
,, ...	Machinery and supplies for drug trade ...	63
France	Chemicals	71
,, ...	Light chemicals, pharmaceutical products ...	71a
,, ...	Paper, leather, turpentine	73
Italy	Pharmaceutical and chemical products ...	75
,, ...	Lubricating oils ...	76
,, ...	Chemical and pharmaceutical products ...	1670, 1676†
,, ...	Soap, perfumery ...	1696†
,, ...	Edible oil	1699†
,, ...	Wood pulp, mineral oils	1703†
,, ...	Leather, imitation and substitutes	1712†
,, ...	Chemicals, dyes, leather	1675†
Netherlands ...	Chemicals, drugs, soap, optical glass, leather	1251
Spain	Lamp filaments, quinine, tanning materials, natural or synthetic indigo, cochineal ...	81
Algeria	Paint, varnish, soap ...	87
,, ...	Edible oils, copper sulphate	89
,, ...	Oils, soap	94
Palestine, Syria	Corrugated iron sheets, chemicals, matches, candles, cement ...	101
Mexico	Heavy chemicals, chlorate of potash, tinplate ...	106
Brazil	Sheep and cattle dips, liniments, embrocations	1262
Chile	Paints, oils, varnishes ...	1203

* High Commissioner for Canada, 19, Victoria St., S.W.1.
† The Secretary, British Chamber of Commerce for Italy, 7, Via Carlo Felice, Genoa.

GOVERNMENT ORDERS AND NOTICES.

EXPORTS.

The following changes in existing export prohibitions have been notified by the Board of Trade:—

Heading transferred from one list to another.

From List A to List C:—Leather.—(July 3).

Altered heading.

(A) Hides, British and Irish cattle. (c) Hides, except British and Irish cattle.—(July 3.)

IMPORTS.

By a Proclamation—to be cited as the Prohibitiou of Import (No. 32) Proclamation, 1919—the importation of the following articles is prohibited:—

Chemicals of all descriptions; electrical goods and apparatus, including electrical plant and machinery of all kinds, and insulating materials of all descriptions; scientific, mathematical, and optical instruments; tungsten powder and ferrotungsten.

With reference to the above Proclamation the Board of Trade has given notice that its terms have been widely drawn for convenience of administration, and that for the present it is not intended to do more than to control the entry into the United Kingdom of certain classes of chemicals of a high degree of purity. The Department of Import Restrictions will therefore almost immediately issue general licences for a large number of chemicals which are not of this description, and they will also issue licences in suitable cases and for limited quantities of the chemicals which are retained under control. For this purpose the Department will be assisted by a committee which is now in process of formation, and which will contain representatives of official, scientific, and trade bodies connected with the chemical industry.

Import Licences.—General licences have been issued in respect of:—Leather of all descriptions; leather board and cut leather stock; paints and enamels. The general licence for pyrites has been revoked, but applications for special licences may be made to the Department of Import Restrictions, 22, Carlisle Place, S.W. 1.

NEW ORDERS.

The Seeds, Oils, and Fats Order, 1919, Ministry of Food, June 23.—The Order restricts dealings in the following articles:—Copra, cotton seed, groundnuts, palm kernels, coconut oil, cottonseed oil, groundnut oil, palmkernel oil, soya oil, premier jus, oleo oil, neutral lard, linseed oil, and linseed.

The Household Fuel and Lighting Order, 1919. Board of Trade, June 23.—This Order appeared in the *London Gazette* of July 1, upon which date it came into force.

Storage of Acetylene.—A Home Office Order (Statutory Rules and Orders, 1919, No. 809, 1*d*.), has been issued prescribing the conditions under which acetylene, when contained in a homogeneous porous substance, with or without acetone or other solvent, shall not be deemed to be an explosive within the meaning of the Explosives Act of 1875. The Order, which is dated June 23, will come into force on August 1, 1919.

Payment of Patent and Trade-mark Fees in Enemy Countries or on Behalf of Enemies.—On July 7 the Board of Trade issued a general licence authorising the payment of fees in respect of the grant and renewal of patents, and of the registration, and renewal of the registration, of trademarks and designs in enemy countries or on behalf of enemies.

PERSONALIA.

We regret to record the death of two distinguished members of the Society, Sir John Brunner, Bart., an original member, and Prof. Adrian J. Brown, of Birmingham University.

The Swedish Academy of Sciences has elected Prof. F. Soddy a foreign member, in succession to the late Sir William Crookes.

According to the *Zeitschrift der angewandten Chemie*, Dr. A. Werner has resigned his professorship of chemistry of Zurich.

Capt. H. J. Page has been appointed head of the chemical department in the Experimental Station and School of Horticulture of the Royal Horticultural Society at Wisley, Ripley, Surrey.

Dr. H. S. Allen, reader in physics at King's College, London, and secretary of the Physical Society of London, has been appointed lecturer in natural philosophy at the University of Edinburgh.

Mr. J. B. Robertson has been appointed lecturer in chemistry in the South African School of Mines, Johannesburg, and Mr. A. E. Walden, professor of chemistry in the Wilson College, Bombay. Both were previously on the staff of the chemical department of Edinburgh University.

OBITUARY.

LORD RAYLEIGH.

The death on July 2 of Lord Rayleigh in his seventy-seventh year has deprived British physical science of one of its most illustrious leaders. From the time when he graduated as Senior Wrangler and took the first Smith's Prize (1865) at Cambridge University until his memorable discovery of argon (1904) his life was crowded with scientific achievements of the first order. His collected papers, published by the Cambridge University Press in 1899-1903, testify alike to his power of work and wonderful versatility. These volumes included some 272 papers and covered a very wide range of subjects among which were acoustics, the measurement of fundamental electric units (including the electro-chemical equivalent of silver), optics, photography, thermodynamics and hydrodynamics, capillarity and viscosity. The achievement for which he will be best and longest remembered by chemists was his discovery of argon in the atmosphere, in the later stages of which he was associated with Sir William Ramsay, and which was the culminating point of a 10-years' research on the densities and other physical properties of gases.

Among the many posts of distinction filled by Lord Rayleigh were:—Cavendish Professor of Physics at Cambridge University, President of the British Association (1884), Professor of Natural Philosophy at the Royal Institution, and Chancellor of Cambridge University. He played an important part in the establishment of the National Physical Laboratory, and served as Chief Gas Examiner under the Metropolitan Gas Acts, with a seat on the Board of Trade Committee which reported on the testing of gas.

A full measure of honours and awards came to him. He was the recipient of honorary degrees from eight universities, was awarded the Royal and Copley medals of the Royal Society, received the Nobel prize for physics (1905), and the Order of Merit at its institution in 1902. Devotion to mathematical physics did not preclude an active interest in practical affairs, his farm of over 7000 acres in Essex being conducted with much success. His eldest son, the Hon. R. J. Strutt, professor of physics at the Imperial College of Science and Technology, succeeds him in the title.

REVIEWS.

Boiler Chemistry and Feed Water Supplies. *By* J. H. Paul. *Pp. ix + 242. (London: Longmans, Green and Co.* 1919.) *Price 14s. net.*

The supply of feed water to boilers is a matter of vital importance to those responsible for the maintenance and safety of steam raising plant and is also a factor to be considered in connexion with the economy of fuel and of steam. The literature dealing with the two latter branches of this large subject, although perhaps rather diffused, is fairly comprehensive, but there is a distinct gap to be filled by an exposition of the chemical and physical properties of waters and of their behaviour at high temperatures and pressures. The author of "Boiler Chemistry" has accomplished this in a most lucid and interesting manner. He conceives the steam boiler as an autoclave in which solutions are concentrated and substances produced during the conversion of water into steam, and has succeeded in the difficult task of explaining chemical phenomena in non-technical language while incorporating a certain amount of hypothetical matter relating to the theory of corrosion which will be of interest to a wide circle of chemists.

The early chapters of the book trace the sources of the impurities found in natural waters due to intimate contact with the atmosphere, and the earth, and to biological action. Interesting information as to the variations in the composition from day to day is given and illustrated by means of graphs.

There is an excellent chapter upon the scales and deposits found in boilers, followed by an outline of softening processes. It is perhaps to this section that the industrial chemist will turn most eagerly, and although basic principles are clearly enunciated, one feels that the value of the book would have been enhanced had more been written about the actual operation and control of softening plants. Many plants are at times called upon to carry an overload, under which circumstances the chemist in charge needs to know rather more about the influence of the time factor upon the process than is given by the author.

The popular belief that water must not be softened below 5° of hardness if corrosion in the boiler is to be prevented is condemned as heresy, and a more rational explanation of corrosion by improperly softened water is offered. The next chapter describes the behaviour of soluble salts within the boiler and the considerations which should govern the use of the blow-off cock. Following this is a contribution to the theory of corrosion.

The author rejects the electrolytic theory and also considers that oxygen has been given more credit than it deserves in the formation of atmospheric rust. Emphasis is laid upon the part played by carbon dioxide within the boiler, and in logical sequence there is given the experimental evidence in support of the hypothesis that many instances of corrosion are due to a molecular rearrangement whereby oxide of iron is formed and the carbonic acid is converted into formic acid and then into aldehyde In setting out this matter at some length the author does not neglect to deal with the diagnosis of corrosion due to other causes.

The concluding chapters deal with the properties of condensed water, the corrosion of superheaters, the prevention of priming and the formation of external deposits on the boiler shell. Every statement made in the book is supported by detailed analytical evidence for which the author assumes sole responsibility, and which will constitute a mine of information for those interested in steam raising. H. Hollings.

THE SPINNING AND TWISTING OF LONG VEGETABLE FIBRES (FLAX, HEMP, JUTE, TOW AND RAMIE). *By* H. R. CARTER. *Second Edition, revised and enlarged, with* 208 *illustrations. Pp. xvi* + 434. (*London: Charles Griffin and Co., Ltd.* 1919.) *Price* 24*s. net.*

The author of this book is ambitious when he endeavours to include in one volume the comprehensive and technical treatment of preparing, carding, spinning and twisting of flax, hemp, jute, tow and ramie yarns; of the manufacture of thread, twine, cords and ropes as well as chapters on mill construction, boilers, engines, steam, water power and power transmission. Any one of the subjects is worthy of fuller and more adequate technical and systematic treatment than is here given. The author claims that the same general principles underlie the preparing and spinning of all "long" vegetable fibres; he might have gone further and included worsted preparing and spinning.

It is certainly confusing when the continuity of the matter is broken by references to each contemporary subject in turn. The sequence of operations is interrupted when the treatment of waste, its preparation and spinning is introduced. It would have been better to have dealt with this section in a separate part of the book and as a distinct industry—which it is. The processes of reeling and bundling should naturally have followed wet spinning. The introduction and discussion of boilers, engines, steam, water power and power transmission are foreign to a book of this character.

The book contains a mass of valuable technical and practical information, but it is scrappy, and the description of machinery details is loose—similar parts being often described by several names which are known to only a few in the trade. A better way is to adopt the common name and adhere to it throughout.

Much of the descriptive matter is inadequate and most of the illustrations are of the machine maker's catalogue type. Many of these are photographs or pictures and occupy a full page or nearly so—they appear without numerals and letters of reference. Such illustrations from a technical point of view are practically useless to the reader or student unless supplemented by specially prepared line diagrams which illustrate the essential details and parts of the mechanism.

Reverting to a few of the points discussed, reference is made on page 27 to the Legrand system of artificial retting, which process can be conducted during 6½ months of the year. Figures are given to illustrate the cost of this process. A further reference on page 30 states that the process is possible all the year round. No explanation is offered for the shorter season on which the figures are based. In connexion with flax roughing (p. 50), 6 to 8 pieces per lb. are given as the usual "piecing" out size. On page 52 the range of pieces per lb. is given as from 2 to 8; such differences in a standard book are misleading and liable to confuse the reader and student alike. The reference to the setting of the sheets in the hackling machine is misleading (p. 60). The author's "recommendations" of setting point to point at the coarse end and slightly intersecting at the fine end are common practice. On page 90 the author rightly says that the weight of the levers should be considered when working out the total pressure on the drawing rollers, yet the solution supplied neglects these lever weights.

Speaking generally this volume is interesting for its historical survey and general description of the textile fibres and the preparation of the raw materials with which it treats.

The incidental comparisons of the subsequent descriptions of the operations and processes involved in the manipulation of the various materials into their respective yarns, threads, twine and ropes of the different industries is not only interesting but instructive and helpful, as comparisons always are. F. BRADBURY.

OSMOTIC PRESSURE. *By* ALEXANDER FINDLAY. *Monographs on Inorganic and Physical Chemistry. Second edition, with* 10 *figures. Pp.* 116. (*London: Longmans, Green and Co.* 1919.) *Price* 6*s. net.*

The second edition of Prof. Findlay's "Osmotic Pressure" retains all the essential features of the original work, but embodies also the most important of the developments that have taken place both on the experimental and on the theoretical side during the past six years. On the experimental side attention is directed to the wide alterations in the type of apparatus used by Morse and his colleagues in Baltimore, including the use of an electrical pressure gauge, whilst on the theoretical side the work of F. Tinker is of special interest. The book is a most valuable monograph and is likely to continue its career of usefulness with increased efficiency in the form in which it is now presented. T. M. LOWRY.

PUBLICATIONS RECEIVED.

GAS AND FUEL ANALYSIS FOR ENGINEERS. *By* A. H. GILL. *Eighth revised edition. Pp.* vi+145. (*New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.* 1917.) *Price* 6*s.*

THE CHEMISTRY AND MANUFACTURE OF HYDROGEN. *By* P. L. TEED. *Pp.* 152. (*London: Edward Arnold.* 1919.) *Price* 10*s.* 6*d.*

THE METALS OF THE RARE EARTHS. *By* J. F. SPENCER. MONOGRAPHS ON INORGANIC AND PHYSICAL CHEMISTRY, *edited by* ALEXANDER FINDLAY. *Pp. x* + 279. (*London: Longmans, Green and Co.* 1919.) *Price* 12*s.* 6*d.*

INDUSTRIAL HANDBOOK. *Indian Munitions Board. Revised edition* 1919. *Pp.* 417. (*Calcutta: Superintendent Government Printing, India.* 1919.)

ETUDES DE PHOTOCHIMIE. *By* V. HENRI. *Pp.* 218. (*Paris: Gauthier-Villars et Cie.* 1919.) *Price* 21 *fr.* 60 *c.*

THE ENERGY RESOURCES OF THE UNITED STATES: A FIELD FOR RECONSTRUCTION. *By* C. G. GILBERT *and* J. E. POGUE. *The Mineral Industries of the United States. Smithsonian Institution. Bulletin* 102, *Vol. I. Pp.* 165. (*Washington: Government Printing Office.* 1919.)

THE INTERNATIONAL MOVEMENT IN FERTILISERS AND CHEMICAL PRODUCTS USEFUL TO AGRICULTURE. (9*th Review.* 1918.) *Documentary Leaflets of the International Institute of Agriculture, Rome. Pp.* 44.

OPPORTUNITIES IN CHEMISTRY. *By* ELLWOOD HENDRICK. *Pp.* 102. (*New York and London: Harper and Brothers.* 1919.) *Price* 8*s.* 6*d.*

DIE HYGIENE DES WASSERS. *Gesundheitliche Bewertung, Schutz, Verbesserung und Untersuchung der Wässer. By* DR. AUG. GÄRTNER. *With* 93 *illustrations and* 11 *tables. Pp.* 952. (*Braunschweig: Friedr. Vieweg und Sohn.* 1915.)

APPARATE UND ARBEITSMETHODEN ZUR MIKROSKOPISCHEN UNTERSUCHUNG KRISTALLISIERTER KÖRPER. *By* C. LEISS *and* DR. H. SCHNEIDERHÖHN. *With* 94 *illustrations. Pp.* 94. (*Stuttgart: Franckh'sche Verlagshandlung.* 1914.)

THE ANNUAL MEETING.

The reasons which led the Council to accept the invitation of the London Section to hold the 38th annual meeting in London have been fully justified by the event. Its historic associations with industry and commerce, its possession of more scientific institutions than any other city in the world, its unique position as the capital of the Empire and its ready accessibility, make London an ideal locality for the meeting place of a Society whose membership includes manufacturers, scientists, and merchants in all parts of the British Commonwealth. The patronage accorded by H.M. the King and H.R.H. the Prince of Wales, combined with the hospitality extended by the Lord Mayor and the Worshipful Masters of the Salters', Goldsmiths' and Clothworkers' Companies, conferred exceptional prestige and importance on the meeting; and the presence of distinguished delegates of Allied Chemical Societies, together with the synchronising of the meetings with the peace celebrations in Paris and London, further contributed to make the occasion one of extraordinary significance for the Society of Chemical Industry, and, we may hope, one of no little moment to the cause of chemical science.

The Opening Meeting.

The address of welcome by the Lord Mayor at the Mansion House showed an appreciation of the value of chemistry to national life which is rare among our public men; were it otherwise, the President in his reply would not have had to lament the fact that the scientific technologist and the man who makes the goods rank lower in popular esteem than the man who barters them. A further advantage arising from the choice of London as the locality of the meetings was the chance it gave to the London press to report the proceedings. This opportunity was taken advantage of to an extent which could not have been anticipated, and we may hope that the precedent will be duly followed. The immense power for good or ill wielded by the ephemeral press must be harnessed to the service of science in the interests, not only of scientific men, but of national security and efficiency.

The President's address brought out some new facts and figures relative to the achievements of British chemists in the successful prosecution of the war, progress in the manufacture of explosives, drugs and aeroplane materials, developments in photography, dyes, glass, edible oils and ferro-alloys all receiving attention. The conclusions drawn were that our scientists had fully proved their ability during the war, and that it now remains to increase their number and opportunities; success in the coming industrial struggle can only be achieved by the same means which brought us victory in the war, namely, greatly increased production.

The Conferences.

Apart from the purely technical matters which were dealt with at the six conferences, there appeared to be an underlying current of opinion that great as the achievements of chemistry undoubtedly have been during the war, we are but on the threshold of making our position secure, and that at all costs—to use the words of Pasteur—"*il ne faut pas s'arrêter aux choses acquises.*" Further, that the industry generally stands in need of more and better organisation, based on the principle of co-operative effort, and of beneficent rather than benevolent neutrality on the part of the State.

As the papers and discussions are printed in detail in the current issue of the Transactions, only brief summaries are given in this place. An account of the conference on sugar production and consumption within the Empire is held over, pending the necessary revision of the statistical and other data which were presented to the conference in a preliminary form.

Conference on the Inter-Allied Chemical Federation.

Sir William Pope described the reasons which had led to the decision to form an international scientific organisation with the Central Powers excluded, and explained the somewhat intricate relationships between the various Inter-Allied and National scientific bodies which have been formed or are in process of formation. As an illustration of the utility of establishing co-operative effort in the sphere of chemistry, he instanced the question of the publication of chemical compendia and abstracts (see this J., 1919, 239 R). This subject has now been under discussion for some considerable time, and it is to be hoped that definite action will soon be taken, preferably on an international basis, but if not, upon a national one. While Allied chemists have been deliberating, German chemists have been acting, with the result that the first volume of the new "Beilstein" has been issued at a price equivalent to about 30*s.* when the low exchange value of the mark is taken into account (this J., 1919, 126 R). However willing Allied chemists may be to avoid using this and other similar German publications, it seems almost unavoidable that they will be forced to do so, and that a vested interest in them will accordingly be created.

With Prof. Armstrong's remarks on the need for good literary style in chemical publications, no one will feel inclined to cavil, but the extent to which the wants of chemists can be adequately met by the provision of well-written monographs is open to question. Handbooks and compendia have proved their indispensability as enlarged indexes and dictionaries of chemical literature: it would add greatly to their size and cost and nothing to their value as "business" documents, which they essentially are, if they were given a more literary dress; but monographs, text-books, annual reports and the like should undoubtedly be made as readable as possible. The main obstacle to immediate action in the publication of chemical compendia appears to be the difficulty of raising the necessary funds; here is a chance for the Government to pay back a little of what it owes to chemistry for services rendered during the war. In accordance with the desire expressed by Sir William Pope that this subject should now be freely discussed, we shall have pleasure in placing our correspondence column at the disposal of those who have opinions and suggestions to bring forward.

Conference on Power Plant in Chemical Works.

This conference was arranged by the Chemical Engineering Group, and, thanks to the efforts of its chairman and secretary, a series of papers was presented which fully deserved the close attention of the large audiences which were present throughout the two sessions.

In the forenoon, Prof. Louis, as chairman, dwelt on the grave situation confronting the nation through the alarming diminution of the coal output, which he considers to be primarily due to the adoption of a minimum wage. He insisted on the duty of the chemical engineer at this critical period to put forth every effort to find means of utilising our available fuel to the utmost. M. Paul Kestner, an honoured guest, speaking on behalf of his French colleagues, wished the newly-constituted Group

prosperity and success, and referred in sympathetic terms to the assistance he had received from British chemists in his early days.

The first paper was by Capt. C. J. Goodwin on "Waste-heat Boilers and Pulverised Fuel in Chemical Works." The subject is too vast a one to be covered *in extenso* within the limits of such a paper, but the material was deftly handled and well illustrated by lantern slides. In the ensuing discussion, Dr. Ormandy, Mr. L. C. Harvey, Capt. Sinnatt and Mr. Ridge brought out other interesting points bearing on the subject. A contribution by Prof. W. A. Bone and Mr. P. St. G. Kirke dealt with the Bonecourt system of incandescent surface combustion and of its application to the firing of multi-tubular boilers with coke-oven and producer gas. During the war the problem of superheat has been investigated and the Bonecourt boiler has been modified to provide for superheats up to the highest degree required in modern power-station practice. In the discussion Prof. Bone stated that low-grade blast-furnace gas could also be used for surface combustion boilers provided it were thoroughly cleaned, but in that case greater efficiency would be obtained by using it in an internal combustion engine.

In the afternoon, under the chairmanship of Dr. C. Carpenter, Mr. P. Parrish gave an excellent paper on "A Chemical Works Power Plant and the Production of Steam from Low-grade Fuel." He dealt with the "power load" of a chemical works, described a typical plant, and discussed the question of centralisation *v.* decentralisation of the power plant as affecting particular works' operations. The use of coke breeze for boiler firing was exhaustively treated and numerous results of continuous tests and comparative cost sheets were given. Prof. Hinchley followed with some useful notes on the economic management of small boiler plants. Mr. H. Martin's "Notes on Electrical Plant in Chemical Works" was not read owing to the absence through illness of the author. The paper urges the need for installing new and efficient electric plants, and discusses the measures to be taken for the introduction of electric power into chemical works.

A pleasing feature of the meetings was the business-like dispatch with which the discussions were conducted. No time was wasted in waiting for speakers, remarks were brief and to the point and the usual irrelevancies conspicuously absent. These results were attained by the previous circulation of abstracts of the papers read, of "discussion slips" for intending speakers to hand to the chairman, and of a few rules for the general conduct of the meetings. The Group is to be congratulated upon the success of its first conference.

Conference on Dyestuffs, Synthetic Drugs and Associated Products.

The large attendance attracted to this meeting was maintained throughout the day, and was duly rewarded by material of much interest. Dr. Herbert Levinstein opened the proceedings with an illuminating and skilfully balanced address on "The British Dyestuff Industry," in which he emphasised the paramount importance to the State which the successful manufacture of colouring-matters represents. Four principal arguments were selected in support of this claim, namely, (1) it is a key-industry, (2) its possession offers a guarantee of peace, (3) it gives an incentive to organised research and is thus related to the development of new industries, and (4) a flourishing dyestuffs industry has considerable political importance as an agent of peaceful penetration. He administered some wholesome and necessary correctives to those complacent spirits who would seem to suggest that it is the English-speaking chemists who have won the war, whereas the real war-work of our chemists lies yet before us. Trenchantly summarising his observations, he declared that it will be madness on our part not to render ourselves economically free in this particular province, that it will be folly to leave Germany in sole possession of the potential arsenals which dye-making factories constitute, and that it will be impossible for us to maintain our commercial supremacy if we neglect this great opportunity to train our research chemists.

Prof. G. T. Morgan described some "Colour-producing Intermediates," and exhibited patterns of chromium, copper, cobalt and vanadium lakes obtainable from hydroxyazo-dyes derived from 2:4-dinitroaniline. Mr. James Morton, discussing "Dyes and British Textiles," traced the probable effects of the three alternative policies which might be adopted in meeting the present situation, namely, (1) unrestricted admission of German dyes, (2) prohibition of entry by tariff and boycott, or (3) temporary control of imports supported by Government subsidy, and outlined the machinery by which the last of these could be operated.

At the afternoon session Mr. E. V. Evans, dealing with the "Manufacture of Intermediates," called for closer co-operation among the sporadic producers, Professor A. G. Green raised an important point in "Patent Laws and the Dyestuffs Industry," namely, the probable attitude of German producers in regard to future inventions, Mr. F. H. Carr dwelt on the part played by the "Manufacture of Synthetic Drugs" in establishing a coherent and interconnected chemical industry, Dr. W. R. Innes drew attention to the war-difficulties encountered by manufacturers of "Photographic Chemicals," and Dr. M. O. Forster pleaded for the "Organised Preparation of Laboratory Chemicals" on the lines developed by Kahlbaum and Schuchardt. Lively discussions occurred at intervals during the day, and to these interludes contributions were made by the chairman, Dr. Rée, the various authors of papers, Prof. H. E. Armstrong, Dr. J. C. Cain, Mr. W. H. Dawson, Mr. D. Lloyd Howard, Mr. L. M. Nash and Prof. W. H. Perkin.

Conference on the Chrome-Tanning Industry.

At the opening of this Conference, held at the Goldsmiths' Hall, the chairman, Mr. F. H. Briggs, referred to the backward condition of the industry in England and attributed this partly to the fact that a large amount of the trade in raw skins within the British Empire had fallen into German hands before the war. The chrome leather manufactured from these skins by the Germans was then largely sold in England. This deplorable condition had recently been remedied, and it seemed probable that in future the chrome tanning of East India kips in England would be carried out on a much larger scale than in the past. Tanners are now thoroughly aware of the advantages to be derived from scientific research, and it was unfortunate that this awakening had not taken place many years ago.

Prof. McCandlish outlined the development of the chrome-tanning industry in the United States. The first successful commercial method of chrome tanning, Schultz's two-bath process, was devised and developed in the United States. Large sums of money had been lost by the pioneers in the industry, but by the exercise of initiative and good business ability it had developed into an industry of enormous proportions. Some of the improvements made in the manufacturing process were described, which indicated that progress had been made by the development of existing methods rather

than by revolutionary changes. Reference was made to the very much larger scale on which tanneries operated in America as compared to England.

Mr. M. C. Lamb dealt with the chrome-tanning industry in Great Britain, and gave an interesting historical account of its development. Improvements in the component liquors of Schultz's original two-bath process were described, and it was shown how these effected economies in practice. However, the one-bath process appealed to tanners in this country, as, in its method of application, it more closely resembled the vegetable-tanning process. Chrome leather had been much used for the uppers of British army boots during the war, and had proved entirely satisfactory. A development of chrome tanning, carried out to a greater extent in England than in any other country, was the manufacture of chrome sole leather. Its waterproof qualities and durability will undoubtedly lead to an increasing demand for this class of leather. Tribute was paid to the debt owed to Prof. H. R. Procter for his valuable contributions to our knowledge of the scientific side of the industry.

In the discussion which followed, Mr. Grant Cooper expressed surprise that such large supplies of raw hides had been allowed to pass out of the British Empire into German hands, and trusted that with increased appreciation of the value of chemical assistance the condition referred to by the chairman would never return. Mr. R. Faraday Innes thought that the British tanner was too slow in realising the advantages accruing from chemical aid. Mr. D. Woodroffe pleaded for closer co-operation, not only between tanner, chemist and foreman, but also between the allied industries manufacturing tannery equipment. A discussion on the training of technical chemists followed, in which Dr. C. A. Keane, Prof. McCandlish, and Mr. Lamb participated.

Conference on Recent Developments in the Fermentation Industries.

After some introductory remarks of an historical nature by the chairman, Sir J. J. Dobbie, Col. Sir F. Nathan read a paper on the manufacture of acetone. When, during the war, Austria ceased to export this substance, the United States became the only source of supply, the quantity produced in this country being negligible. Catalytic processes involving the use of alcohol and of calcium carbide as raw materials had been successfully worked out. The Weizmann process was used in this country, but it attained the largest measure of success at Toronto, where, in 1918, an output of 200 long tons per month was reached. At Toronto, also, a successful catalytic process was devised for converting the by-product butyl alcohol into methylethylketone, which can satisfactorily replace acetone in the manufacture of cordite. Although it has been proved during the war that acetone can be manufactured by the fermentation of substances containing starch, this method is not likely to compete with its production by the destructive distillation of wood.

Mr. Amos Gill described in detail the morphological characteristics of the micro-organism used by C. Weizmann for the production of acetone and butyl alcohol from cereals, and discussed a number of interesting points in connexion with the application of the process. The procedure as carried out at King's Lynn factory was described in detail, also the various devices adopted to keep the plant and cultures aseptic.

In the ensuing discussion, Prof. A. Fernbach claimed priority for the discovery of the fermentation process for making acetone and butyl alcohol from starchy materials, and stated that he had shown it to Dr. Weizmann. The Fernbach and Weizmann processes were identical. Sir F. Nathan agreed to this claim and added that his Department had been using bacteria provided by Dr. Weizmann. The process had been used in this country, Canada and the United States, and in every case with some form of grain and not with potatoes. The Hon. F. R. Henley said he had used horse-chestnuts, but it was impossible to carry through fermentation unless all husk was removed, which in practice was impossible. By mixing chestnuts with maize or rice, fermentation could be effected.

Mr. Chaston Chapman directed attention to the inadequate provision made in this country for systematic instruction in industrial micro-biology. Although much work has been done on brewing and distilling the minor fermentation industries have been left largely to take their chance. Lactic acid was cited as an example and statistical information showed that in 1912 we were not able to supply our own requirements but were importing largely, in some cases from our former customers. Much of the lactic acid is made in a haphazard manner, the quality being poor and the cost of production high. The author also discussed the desirability of an institution being devoted to the systematic prosecution of original research in connexion with any industry in which micro-organisms or enzymes play an important part. Such an institute would also provide organisms in pure culture and in quantities sufficiently large for industrial purposes.

Mr. Brierly urged the extension of the pure culture laboratory at Rothamsted, and in drawing attention to the Association of Applied Biologists suggested that the Society of Chemical Industry might have joint meetings with that body. Mr. F. L. Lloyd discussed the great difficulties of obtaining and retaining pure cultures for technical purposes, and the chairman suggested that an association on the lines indicated by Mr. Chapman might be formed in connexion with the Department of Scientific and Industrial Research.

The Social Functions.

The social gatherings in connexion with the meeting were, fittingly, of a more numerous and elaborate character than those held during the past few years, and the revived experience of such functions emphasised their great value both from a social and a professional standpoint. In addition to the luncheon, to which 360 members and guests sat down at the Connaught Rooms, and the annual dinner at the Savoy Hotel attended by some 250, successful soirées were held at the Imperial College and the British Scientific Products Exhibition. The final day was devoted to a visit to Windsor Castle, including St. George's Chapel, the Albert Memorial Chapel and the State Apartments, a luncheon at the White Hart Hotel, Windsor, and to an enjoyable trip on the Thames from Windsor to above Maidenhead. About 200 people took part in this excursion. The pleasure of these entertainments was much enhanced by the company of colleagues from the Allied countries who were taking part in the Inter-Allied Conference, and not less by the presence of many lady guests. The hospitality offered by the Chemical Industry Club also materially assisted in giving members and their friends valuable opportunities to meet, fraternise, and exchange ideas. At the final function—the lunch at Windsor—Prof. Louis took the opportunity of expressing the gratitude of all to the London Section, and in particular to its chairman and secretary, for their hospitality and the immense amount of trouble which they had taken, and of congratulating them upon the complete success of their efforts.

THE INTER-ALLIED CHEMICAL CONFERENCE.

Meetings of the delegates appointed to represent the Allied countries were held at the Salters' Hall, London, E.C., from July 14—17, inclusive. Six sessions were held, and the various nations were represented as follows:—

Belgium. M. Lucion, past-president of the Société Chimique de Belgique; M. Timmermans, associate professor in the University of Brussels. *France.* M. Moureu, member of the Institute of France and professor at the Collège de France; M. Kestner, president of the Société de Chimie Industrielle; M. Béhal, member of the Académie de Médecine and professor at the Ecole Supérieure de Pharmacie de Paris; Dr. Marquis, chief editor of the Bulletin de la Société Chimique; Dr. Marie, general secretary of the Société de Chimie Physique; M. Voisin, member of council, Société de Chimie Industrielle; and M. Gérard, general secretary of the Société de Chimie Industrielle. *Italy.* Dr. O. Severini, director of the Società Generale per la Cianamide; Dr. G. Pirelli, representing the Società di Chimica Industriale of Milan. *United States.* Dr. F. G. Cottrell, chief metallurgist, U.S. Bureau of Mines; Dr. C. L. Parsons, chief chemist, U.S. Bureau of Mines, secretary of the American Chemical Society; Dr. E. W. Washburn, professor of ceramic chemistry at the University of Illinois, past-chairman of the Division of Chemistry and Chemical Technology of the National Research Council. *United Kingdom.* Sir William Pope, professor of chemistry at the University of Cambridge, chairman of the Federal Council for Pure and Applied Chemistry; Prof. H. Louis, professor of mining at Armstrong College, University of Durham, president of the Society of Chemical Industry, Prof. H. E. Armstrong, past-president of the Chemical Society; Dr. E. F. Armstrong, vice-chairman of the Association of British Chemical Manufacturers; Mr. A. C. Chaston Chapman, past-president of the Society of Public Analysts; Prof. W. P. Wynne, professor of chemistry in the University of Sheffield. The following also attended by invitation: Dr. R. F. Ruttan, director of the department of chemistry, McGill University, Montreal, president of the Royal Society of Canada, and Dr. H. Hibbert from the United States.

The proceedings of the Conference were conducted in French, M. Moureu acting as chairman, and M. Gérard as secretary. Almost the whole time of the Conference was taken up in framing the constitution of the new body (*v.i.*), which is to be known as the "International Confederation of Associations for Pure and Applied Chemistry" (Confédération Internationale des Associations de Chimie Pure et Appliquée), and in discussing the desirability of its inclusion in the scheme of organisation projected by the Conference of Scientific Academies. The following officers were elected for a term of three years:—President, M. Moureu; Vice-Presidents, M. Chavanne (Belgium), Signor L. Parodi Delfino, Dr. C. L. Parsons, and Sir William Pope; General Secretary, M. Jean Gérard (49, rue des Mathurins, Paris).

In addition to the five countries represented as above it was decided to admit neutral countries which have not bound themselves by association with any other international organisation having similar objects. It was also agreed that the British Dominions and the nations signatory to the Peace Treaty should each have separate representation on making application. In this connexion Canada and Poland have already signified their adhesion. After participating in the peace celebrations on July 19, many of the delegates journeyed to Brussels to take part in the proceedings of the International Research Council, July 22 being the date arranged for the consideration of affairs relating to chemistry. The relationships between the International Research Council, the International Chemical Federation and the constituent members of each are clearly set out in the address given by Sir William Pope at the Mansion House on July 15 (see this issue, p. 208 T); it may be of interest, however, to add that with the exception of Belgium, each of the nations at present represented on the International Chemical Federation has formed a national organisation similar to our Federal Council for Pure and Applied Chemistry; thus the United States has instituted a Chemical Division of the National Research Council; France, the Fédération Nationale des Associations de Chimie Pure et Appliquée; Italy, the Associazone Italiana di Chimica Generale ed Applicata (see p. 270 R of this issue). Before adjourning, the Conference resolved to hold its next meeting in Italy, towards the middle of June, 1920. A translation of the rules adopted and of the resolutions passed is given below:—

RULES.

I. The National Federations or National Councils of the Chemical Associations of Belgium, the United States of America, France, the United Kingdom of Great Britain and Ireland, and Italy agree to form an international association to be known as the International Confederation of Associations for Pure and Applied Chemistry, and having as its objects:—

(i) To reinforce between the Allied peoples the bonds of esteem and friendship which have already been strengthened during the war.

(ii) To organise permanent co-operation between the chemical associations of the different countries.

(iii) To co-ordinate their scientific and technical activities.

(iv) To contribute to the advancement of chemistry in all its branches.

No limitation is set to the duration of the Confederation. Its provisional headquarters are to be in Paris.

II. The admission of a country to the Confederation is subject to the conditions laid down in the rules of the International Research Council.

Membership of a country in the Confederation to be effected through its National Federation or National Council, or in the absence of these, through a national association representing chemistry.

III. The Confederation shall act through a Council assisted by a permanent secretarial staff with a special office, the appointment of which will form the subject of an international agreement between the constituent countries.

IV. The annual subscription is fixed for each country at a rate proportional to the number of its inhabitants, in accordance with the following table:—

	Population in million of inhabitants.	Minimum annual subscription.
Category A ...	less than 5	500 francs
,, B ...	from 5 to 10	1,000 ,,
,, C ...	from 10 to 15	1,500 ,,
,, D ...	from 15 to 20	2,500 ,,
,, E ...	from 20 to 30	3,500 ,,
,, F ...	more than 30	4,500 ,,

Members of the Confederation are only liable for expenses connected with the general administration. No further expenditure can be demanded unless their consent thereto has previously been obtained.

V. Withdrawal from the Confederation is subject to two years' previous notice and to all obligations being fulfilled.

Membership may be determined by a majority of two-thirds of the members of the Council, either present or represented, for non-payment of the minimum annual subscription or for a serious offence, the member having previously been called upon to furnish explanations.

VI. The Confederation to be administered by a Council consisting of delegates of each of the contracting countries, the number of whom is fixed according to their category as indicated below :—

	Delegates.
Category A	1
,, B	2
,, C	3
,, D	4
,, E	5
,, F	6

The delegates are appointed for three years by the Council of the National Federation or the National Council of their respective countries. One-third of the number shall retire annually but shall be eligible for re-election.

VII. The Executive Authority of the Council shall consist of a president, four vice-presidents and a general secretary.

The Council shall elect (by a majority) these officers from amongst its own number, every three years; they shall not be immediately eligible for re-election to the same office. The president to be chosen from among the vice-presidents.

VIII. The Council shall meet at least once a year on the day before the annual general meeting in the town where the latter is to be held, and, in addition, as often as it shall be convened by its president or upon the requisition of one-fourth of its members.

The Council shall fix the date and place of meeting, draw up the budget, and decide as to expenses.

Resolutions shall be adopted by a majority, each nation having the right to only one vote.

In matters appertaining to administration and finance, votes shall be given by countries, each nation having a number of votes equal to that of its delegates. Proxies may be appointed by the delegates of any nation to represent them and vote in their name. Postal votes are permissible, but only on matters appearing on the agenda. The chairman to have a casting vote.

IX. Minutes of the meetings shall be kept. Two copies of these minutes shall be signed by the chairman and the secretary of the meeting.

The permanent secretarial staff shall have the custody of the archives, and be entrusted with the execution of the resolutions adopted by the Council and the Executive, and in particular with the circulation of the agenda.

X. The functions of the Executive shall be :—

(1) To see that the rules are strictly observed; (2) to prepare the agenda for meetings of the Council; (3) to record and carry out the decisions of the Council; (4) to perform during the entire period elapsing between two meetings of the Council the necessary acts of administration and to report on the same in writing to the members of the Council; (5) to submit to the Council a draft yearly budget; (6) to represent the Confederation, or to appoint its representatives.

XI. There shall be instituted, in addition to the Council, a consultative committee, consisting of as many sections as shall be necessary to ensure the complete representation of pure and applied chemistry in conformity with the regulations of the Confederation.

XII. The annual meeting to be attended by members of Council and delegates of the various National Federations or National Councils.

An ordinary general meeting, to be called a Conference, shall be held at least once every year, preferably in the locality where the International Congress of Pure and Applied Chemistry is held and at the same time.

The Conference shall meet whenever it is called by the Council, or at the request of at least one-half of the members of the Confederation.

The Conference shall receive the reports on the administrative work of the Council, on the financial situation, and on the general position of the Confederation.

It shall adopt the accounts for the past financial year, as certified by an auditor elected from outside the body of the Council and appointed by the Conference of the previous year. It shall pass the estimates for the forthcoming financial year and discuss questions placed upon the agenda.

The annual report and the accounts shall be sent to all the members at least three months before the meeting of the Annual Conference.

The agenda of the Conference shall be drawn up by the Council and must include every question which shall have been transmitted to it by any of the members of the Confederation three months at least before the holding of the Conference.

The Conference shall be served by the same secretarial staff as the Council.

Votes on administrative and financial questions shall be cast by countries, each of which shall be entitled to the number of votes indicated in the categories specified in Rule VI.

The delegates of any country may appoint one or several proxies to represent them and vote in their name.

XIII. Expenditure shall be authorised by the president and disbursed by the permanent secretary.

The Confederation shall be represented in all civil and legal proceedings by the permanent secretary.

XIV. Resolutions of the Council relating to such purchases, exchanges, and transfer of real property as may be needed for the accomplishment of the objects of the Confederation, grant of mortgages on the said properties, leases for more than 9 years, transfers of properties and loans, must be submitted to the Conference for approval.

XV. Suggested alterations in the Rules may only be submitted to the Conference on the initiative of the Council of the Confederation, or on the application of one of the constituent National Federations or National Councils.

The proposals for alteration shall appear on the agenda of the Conference provided they have been received in writing at the office of the Confederation at least three months previously.

Votes shall be taken by countries.

Postal votes to be allowed in this case.

The Rules can only be altered by a majority of two-thirds of the votes cast.

XVI. In the event of the Conference being convened to decide upon the dissolution of the Confederation, special notices to that effect shall be sent three months in advance; and at least three-quarters of the members of the Confederation or their proxies must be present.

If this proportion is not reached, the Conference shall be adjourned for not less than six months, when the decision of the adjourned meeting shall be operative, irrespective of the number of members present.

In any case, dissolution can only be resolved upon by a majority of two-thirds of the votes cast.

XVII. In the event of dissolution the Conference shall appoint one or more trustees to liquidate the property of the Confederation; and any surplus assets shall be given to an international institution.

XVIII. In the interpretation of these Rules the French text shall be authoritative.

Resolutions.

The International Confederation of Associations for Pure and Applied Chemistry, meeting in conference in London from July 14 to 18, 1919, hereby records the following opinions:—

1. That the Confederation should be included in the scheme of organisation contemplated by the Conference of Scientific Academies, with autonomous powers, as the Chemical Section of the International Research Council.

2. That it shall constitute "The International Committee of Chemistry."

3. That the various national delegates representing chemistry at the meeting of the International Research Council shall be appointed by the same National Federation which appoints the delegates to the Confederation.

4. That the officers of the present Confederation be, *ex officio*, officers of the Chemical Section of the International Research Council.

* * *

M. Jean Gérard, writing from Brussels on July 24, states that, in order to satisfy the requirements of the International Organisation of Scientific Academies, slight alterations in the form of some of the Rules adopted by the London Conferences were made by the delegates appointed to represent it at the Brussels Conference; that the modified Rules (as given above) were approved by the Organisation; and that the Confederation has been admitted to the International Research Council as the Chemical Section, in accordance with Resolution 1 above.

POWER ALCOHOL.

The Report of the Inter-Departmental Committee on the production and utilisation of alcohol for power and traction purposes marks a far reaching and welcome advance in Government enterprise. Comparatively few of the public realise how important power alcohol will become in the future if rapid transport, whether by land, sea or air, is to be developed to the extent which recent achievements have made probable. The known oil supplies of the world are estimated to last only a limited period, and even if productive new fields are discovered there still remains the need of providing alternative supplies of motor fuels derived from new raw materials. The fundamental fact that the vegetable raw materials from which alcohol can be manufactured are being continually renewed and are capable of great expansion makes alcohol motor fuel the ideal for the future, and any State which neglects to encourage and to prepare for its application to these purposes is ignoring the best interests of its citizens.

The problem is far too big to be undertaken by private enterprise, and we therefore welcome the recommendation that the time has come for the Government to ensure close investigation of the questions of production and utilisation, in all their branches, of alcohol for power and traction purposes.

It is the question of production and the restrictions governing utilisation which are of greatest interest to the industrial chemist. The outlet for alcohol in the chemical and allied industries is very large were it not for the many restrictions governing its use. It is unthinkable that the use of alcohol for power purposes will be permitted on better terms than are allowed to the chemical industry. How onerous are the restrictions at present regulating the use of alcohol may be seen from the emphatic recommendations for their abolition contained in the Report.

Obviously, power alcohol must be made unfit for human consumption and proof against illicit purification to render it potable. The present denaturing process is very costly, adding as much as 6d. to the price per gallon, and it is suggested that the proportion of wood naphtha, the principal denaturant, should be reduced as much as possible. This was done during the war owing to the shortage of wood spirit without detriment to the State, and it is a source of great hardship to many industries, in particular the photographic, that a return has since been made to the pre-war practice.

The Committee suggests that petrol, benzol or other nauseous substances supplemented by a small quantity of methyl violet should be used, and that every effort should be made to provide alternative denaturants—for example formaldehyde, pyridine and tobacco oil—the employment of which will be effective in the smallest possible quantities. Power alcohol must be denatured at the lowest possible cost per gallon compatible with the protection of the revenue.

Greater facilities are required to permit the necessary volumetric mixings during denaturing; transportation by rail or road in tank wagons instead of in barrels or small containers must be allowed. It must be made possible to ship power alcohol in tank steamers and to handle and store it in bulk at the ports of arrival. Generally, the present restrictions concerning its manufacture, storage, transport and distribution will have to be largely removed if power alcohol is to be handled cheaply and expeditiously in large quantities.

Needless to say the Committee advocates the production and importation of power alcohol free of duty.

Alcohol may be produced from vegetable sources or by synthetic processes. Potable alcohol has in the past been produced from foodstuffs but with the prevailing world shortage these will be far too costly to serve as raw materials for power alcohol. As vegetable growth is dependent on ample sunshine and suitable temperature, its economical production can only be effected in tropical and sub-tropical regions from such materials as molasses and quickly grown sugar or starch-containing products. Special attention is directed to the flowers of the mahua tree (*Bassia latifolia*) in India as a source of alcohol.

Wood and wood pulp lyes and possibly peat may perhaps serve as sources of fermentable material after hydrolysis, and systematic research into these questions is desirable.

The only synthetic production considered by the Committee is that from ethylene derived from coal and coke-oven gases, and it is considered that a large potential source of power alcohol is thus available, but much further research is required, particularly as regards the catalytic conversion of the ethylene into alcohol before definite figures as to cost can be given. No mention is made of the production of alcohol from acetylene derived from

carbide; this is a well-established technical process and given cheap carbide should compete favourably as regards cost.

It is of course essential that the price of power alcohol must be such as to enable it to compete with petrol and to ensure cheap transport, which is more than ever necessary now that our railways under State control have failed to cope with the national traffic.

The Committee urges the Government to establish forthwith an organisation to initiate and supervise experimental and practical development work on the production and utilisation of power alcohol, and it is to be hoped that effect will be given to this recommendation without delay. The diminishing supply of coal in this country makes it urgent that steps shall be taken to supplement it by other fuel, and if the nation can applaud the expenditure of a million pounds to search for oil under Britain it should be eager to expend a like sum on the development of power alcohol.

A full abstract of the Report appeared in our last issue (July 15, p. 250 R).

LECTURES AT THE BRITISH SCIENTIFIC PRODUCTS EXHIBITION.

On July 7, Sir William Tilden gave an address on "Chemistry in Reconstruction."

A visitor to the exhibition could not fail to experience the comforting conviction that British chemical manufacturers are now quite capable of holding their own in regard to variety and quality of products. They will undoubtedly be able to supply this country with drugs, dyes and other necessaries so long as they continue to exhibit the same skill, energy and resource which has been gradually developed during the last five years and provided they continue to receive for a time adequate protection from foreign imports. With regard to trade outside the United Kingdom it is too soon to indulge freely in optimism. In a recent speech the Prime Minister pointed to the condition of German territory, which has not been damaged or disturbed to any appreciable extent by the operations of the war, and which retains the famous chemical establishments with plant and machinery in working order, and even extended by material stolen from Belgian and French factories. Moreover, Germany has the services of a very large body of technical chemists of great skill and experience, and she will naturally make greater efforts than ever to penetrate into foreign markets. Then there is Switzerland with good schools of chemistry and an already established chemical industry. During recent years the United States has vastly extended the chemical departments of its universities and technical schools, and put up much new capital for the development of chemical manufactures. Japan, also with a well-equipped university, many natural products, and cheap labour will certainly appear in the field.

All these will undoubtedly prove very formidable competitors in the race in which the British chemist will have to enter. In this country also there is still a great deficiency in the number of well-qualified chemists available for the service of industry. The manufacturer has too long been satisfied with the services of the laboratory boy, who can be taught to perform routine testing without any knowledge of more than the most elementary chemical principles. We require a large number of well-educated men equipped with the fullest possible knowledge of modern chemistry in every branch. Referring to the problem of converting the academic into the industrial chemist, Sir W. Tilden said there can be little doubt that this is best accomplished in the works, and in the long run manufacturers will find it pay best to employ the academic chemist thoroughly drilled in the practice of analysis and well acquainted with all the methods of research, who must be assumed also to possess common sense, and give him time and facilities for becoming acquainted with constructive materials and that amount of elementary engineering which is requisite for his work.

One great feature of modern chemical manufacture is the production by synthetic processes of compounds which hitherto have been obtained from natural sources. Of these the most remarkable is the production of ammonia from hydrogen and atmospheric nitrogen, which notwithstanding physical difficulties is likely to proceed on a very large scale. Another case of a different kind is the production of rubber which has been going on in Germany during the war. There can be no doubt that in a few years this substance will appear on the market, provided the initial material, at present acetone, is available at a sufficiently cheap rate. Synthetic rubber now obtainable in the laboratory costs about twenty times as much as the natural article from the plantation.

In his lecture on "Coal Conservation," on July 11, Prof. H. E. Armstrong urged that the problems of coal should be treated comprehensively without further delay, so that the issues may be properly considered and a scheme worked out in which all interests are taken into account and the general requirements of the public fully met. The mere provision of a limited number of large central power stations foreshadowed in the Electricity Supply Bill will not alone suffice, he considers.

Two main objects should be kept in view:—(1) The due utilisation of every product that can be economically extracted from coal; (2) The provision of a smokeless solid fuel for public use, so as to abolish the smoke nuisance. In the not distant future gas should be all but entirely supplanted as a lighting agent by electricity; and the gas that is required for heating purposes should be obtainable as a by-product: the production of gaseous fuel, that is to say, should no longer be in the hands of a separate industry.

The carbonisation of coal cannot be treated merely from the economic standpoint. In view of the prospective world-shortage of petroleum, it will be criminal folly if we fail to produce all the oil fuel that can be obtained by subjecting our supplies of bituminous coal to a preliminary distillation at a relatively low temperature.

In the scheme laid down in the lecture, it is contemplated that the supply of raw coal would be confined to certain centres governing selected areas; as soon as such centres were brought into effective action, the use of raw bituminous coal in their areas should be forbidden. The coal would first be carbonised at the centre in such manner that the maximum yield of by-products, gaseous and liquid, would be secured, together with a residue which could be in part supplied for domestic or manufacturers' use and in part used at the centre in generating electric power, preferably after gasification in a producer in order to recover the nitrogen as ammonia. Domestic needs would be best met by carbonising a certain proportion of coal of special quality, so as to produce a standard smokeless fuel containing a minimum proportion of ash; coal of lower grade would be used for power purposes. Each centre would be the local source of supply for every kind of fuel, as well as of electric power. That great economy must be effected in our use of coal has long been clear, if only on the grounds of the prospective exhaustion of our supplies. The sudden rise in price has

now created a situation so full of peril that action cannot any longer be stayed. A fusion of the interests must therefore be enforced, so as to get rid of all unnecessary charges; and efficiency must be aimed at in every direction.

It is recognised that the position in which the gas industry is placed is one of peculiar difficulty. The gas companies can no longer afford to pursue their antiquated methods and continue to manufacture gas by merely heating coal; the quantity of coal required for the purpose would be too great and the coke produced would not be suitable for domestic use. The change foreshadowed in the technical press would involve the production of a very weak gas which, in the opinion of the lecturer, would be unsuitable for domestic use. But if the rich gas obtained in carbonising the large quantities of coal dealt with at each of the centres advocated were to form the basis of the supply, it would be possible to dilute this to no inconsiderable extent and yet supply a gaseous fuel of superior calorific power really suitable for use in gas stoves.

In this connexion, reference was made to the recent report to the Board of Trade by the Fuel Research Board on Gas Standards: this is misleading, as no account is paid in it to quality, except as defined by calorific power. It may be questioned whether the Committee were a competent body to deal with so complex a problem.

Reference was also made to the indubitable superiority of the open fire of solid fuel to the gas fire. Prof. Bone, in the subsequent discussion, also laid emphasis on this point.

THE ASSOCIATION OF BRITISH CHEMICAL MANUFACTURERS.

The third annual meeting of the Association was held in the rooms of the Chemical Society at Burlington House on July 10, and was followed in the evening by a dinner at Princes' Hotel.

In his speech at the annual meeting, the chairman, Mr. R. G. Perry, described at length the useful work which had been done by the Association during the past year in consolidating the industry and strengthening the position of its various branches (see this J., 1919, 252 R). He pointed out that we are only on the threshold of a great dye industry in this country, and this question had engaged the close attention of the Council. The Association has been recognised by the Board of Trade, and Dr. A. Rée and the General Manager, Mr. Woolcock, have acted as members of the Trade and Licensing Committee. In addition Lord Moulton, who is honorary president of the Association, has accepted the chairmanship of British Dyestuffs Corporation. Close attention has been given to parliamentary legislation in so far as it affects chemical industry, and especial consideration has been devoted to patent law and traffic problems. A strong Commission of the Association, representative of all branches of the industry, has recently made a comprehensive report on its visit, under Government auspices, to the chemical factories in the occupied area of Germany. It is worthy of note that during the year an "*Entente cordiale*" has been established between the British and French chemical industries, and collaboration between the two should be to their mutual advantage. After touching on many matters of domestic interest the chairman stated that he was called upon to give evidence before the recent Coal Commission and to give his views on the control of productive operations by Public Departments (this J., 1919, 175 R).

In the discussion which followed appreciation was expressed of the work done by the Council, and it is evident that the chemical industry has derived great benefit from the activities of the Association since its formation in 1916.

In the evening a distinguished and representative gathering dined at Princes' Hotel, and among the guests of the Association were:—Gen. Sir Wm. Birdwood, Sir J. J. Dobbie, the Earl of Dunmore, Mr. T. G. Feasey, Lord Glenconner, General Hartley, Mr. J. Fitzallan Hope, Sir Herbert Jackson, Sir Evan Jones, Mr. F. G. Kellaway, Sir A. Steel Maitland, the Rt. Hon. Sir Alfred Mond, the Rt. Hon. Lord Moulton, and Mr. R. T. Nugent. The toast of "H.M. Ministers" was proposed by Lord Moulton and responded to by Sir Alfred Mond. Lord Moulton expressed the great anxiety he had experienced in the early days of the war at the lack of important chemical industries vitally necessary to save this country from defeat and wondered to what extent the nation realised the importance of chemical industry. In proposing the toast of "The Association," Mr. F. G. Kellaway enlarged upon the remarkable achievements of British chemists and the great part played by the industry as a whole. The toast was responded to by Mr. Max Muspratt. Dr. C. Carpenter, vice-president of the Association, gave the toast of "Our Guests," which was replied to by the Earl of Dunmore and General Birdwood. The toast of "The Chairman" was proposed by Sir William Pearce and briefly acknowledged.

CHEMICAL STANDARDS.

By invitation of the Council of the Institute of Chemistry, a Conference was held on June 26 to consider the advisability of making provision for the preparation and issue of authoritative samples of chemical substances, metals, etc., of ascertained composition. The Conference was attended by representatives of the following public bodies:—The Federal Council for Pure and Applied Chemistry, the Chemical Society, the Society of Chemical Industry, the Society of Public Analysts, the Institute of Metals, with the Standards Committee of the Institute of Chemistry. The conclusions arrived at were:—

That the provision of standard chemical substances was desirable, for the general use of both chemists in practice and students.

That having regard to the fact that such standards could not be provided without reference to methods of analysis, the scheme should not aim at restricting the choice of methods, but always to their revision and improvement, thereby diminishing the chances of discrepancy in results. Incidentally, by this means, science will be advanced and accuracy more generally attained.

That, in view of the importance of analysis in carrying out the scheme, the whole matter should be referred in the first place to the Society of Public Analysts, with a suggestion that the Society should form a Special Committee on which representatives of the allied Bodies should be co-opted.

That the Society be asked to frame a scheme for the consideration of the Federal Council for Pure and Applied Chemistry, reporting on its practicability, the cost of the investigations involved and the organisation generally.

That ultimately the scheme be submitted to the Department of Scientific and Industrial Research and, if necessary, the support of the Conjoint Board of Scientific Societies should be asked to secure the co-operation of the Government in its fulfilment.

That, in the event of the Government placing the matter under official control, provision should be made for the co-operation in the scheme of the recognised Bodies concerned with chemistry and their respective members.

MEETINGS OF OTHER SOCIETIES.

THE FARADAY SOCIETY.

The first paper presented at the meeting held on July 14 (Professor A. W. Porter in the chair) dealt with the application of magnetic tests to determine hardness in steels, and described a method of measuring the so-called "magnetic hardness." The author—Mr. L. A. Wild—claims that while the method will not measure "every sort of hardness, ... it is of very great utility for the investigation of heat treatment problems." In the discussion which followed several speakers, including Dr. J. A. Harker, criticised the definitions which the author had given of certain already well-defined processes, such as normalising, annealing, etc.

A paper on "The Disappearing Filament Type of Optical Pyrometer," by Mr. Forsythe, was communicated by Dr. Ezer Griffiths. In this type of instrument a small tungsten- or carbon-filament lamp is mounted in the focus of the eyepiece of a telescope which is sighted on to the object whose temperature is required. The current through this lamp is varied until the filament just disappears against the background. The current is a function of the temperature required. The paper goes very thoroughly into the theory of the instrument and its adjuncts, the methods of calibration, the various errors which may arise and the accuracy attainable.

Prof. K. Honda and Mr. H. Takagi contributed a paper "On a Theory of Invar." The fact that Invar has no thermal expansion at ordinary temperatures is explained on the ground that the addition of 35·4 per cent. of nickel lowers the temperature of the A3 transformation to the vicinity of room temperature. It is known that at this point the slope of the volume change curve is at a minimum, the metal expanding with rise of temperature up to this point and then contracting.

Mr. E. A. Ashcroft described certain alloys of lead and magnesium which have the property of absorbing oxygen in the presence of water vapour. The alloys possessing this property contain between 50 per cent. and 95 per cent. of lead. In the discussion it was suggested that the effect was probably an electrolytic one. Various speakers suggested different uses for the alloy, one being the manufacture of argon by the absorption of oxygen prepared from air and another was to keep a certain amount of the alloy in the gas bags of airships in order to prevent the hydrogen from becoming seriously contaminated with oxygen.

Other papers were (1) "The Mechanism of the Surface Phenomena of Flotation," by I. Langmuir; (2) "The Electrolysis of Solutions of Sodium Nitrate using a Silver Anode," by F. H. Jefferey; and (3) "On the Equation for the Chemical Equilibrium of Homogeneous Mixtures, Part I.," by Prof. Porter. A good discussion followed the reading of the first of these papers, reference being made, amongst other things, to the amazingly small quantity of oil—tablespoons in tons of water—required to produce flotation. Prof. Porter's paper was taken as read.

OIL AND COLOUR CHEMISTS' ASSOCIATION.

A paper on "The Measurement of Temperature," with special reference to the needs of manufacturers of paints and varnishes, was read by Mr. R. S. Whipple before this Association on July 10. After dealing with the general subject of thermometry and pyrometry, the author summarised the practical considerations underlying temperature measurement in oil and colour works as follows :—

In the laboratory nothing can exceed the convenience of the mercury-in-glass thermometer for temperatures up to 300° or even 400° C., but in the works, for temperatures up to 300° C., the mercury-in-steel thermometer is to be preferred. For this purpose the steel tube must be protected by means of lead covering. As comparatively long capillaries may be used with these instruments, there is no difficulty in fixing the bulb into a vat, and the reading part of the instrument several feet away from it.

In many processes, such as the manufacture of varnishes and in the preliminary preparation of linseed and other oils, the reading of temperatures up to 300° or 400° C. is best performed with either resistance or thermo-electric thermometers. For taking the temperature of a group of pans or vats it is generally advisable to instal a switchboard so that any one of several thermometers can be read on the one galvanometer. If an open temperature scale is required, then a resistance thermometer should be employed, but if the thermometer is to be taken in and out of the vessels continually it is preferable to use a thermo-couple. A couple is more robust than a resistance thermometer and is more easily renewed. Thermocouples should be employed for temperatures between 800° and 1000° C., *e.g.*, in the manufacture of litharge. For temperatures not exceeding 900° C. some of the protected base metal thermocouples, such as Hoskins nickel-chrome, or the Titan couple may be used. For temperatures above 1000° C. it is advisable to employ platinum-rhodium couples. In the frit furnaces either radiation or optical pyrometers should be used. The decision as to which type of pyrometer should be used depends very much on the class of labour working with the pyrometer. If the temperatures are to be read and not recorded, and if a fairly skilled observer is to use the instrument, then an optical pyrometer should be employed. If, on the other hand, an untrained observer is to take the temperatures, a Féry radiation pyrometer should be used. The Féry instrument has also the advantage that a record of the temperatures can be taken without serious difficulty.

LEGAL INTELLIGENCE.

APPLICATION FOR LICENCE TO USE ENEMY PATENT.

In the Patents Court on July 10 an application was made by the Citex Fire Extinguishing Co., Ltd., of London, for a licence to use German patent 10086/1908, in the name of Roemer, for the production of carbon dioxide for use in fire-extinguishing apparatus. The patent claimed the use of a solution of potassium carbonate (96—98 per cent. purity) for the production of the carbon dioxide required.

The secretary of the applicant company said that it had been manufacturing the chemical charge continuously for several years; originally it had an arrangement with the patentee, although this had not been registered, and the company had to pay the patent renewal fees and a royalty of 1*s.* on each cartridge, which sold at about 8*s.*

The Comptroller of Patents said that application should have been made previously. It was debatable whether the arrangement specified was a valid one. The secretary said that the royalties were credited to the patentee, and that the company did not want to pay anything unnecessarily. The Comptroller said this might be a question under the Peace Treaty, and would be raised afterwards. He would recommend the grant of the licence by the Board of Trade.

CORRIGENDA.—In the issue of June 16, p. 202 R, col. 1, line 35, read "eventually became," in lieu of "on coming to Canada acted as"; in the issue of July 15, p. 256 R, under "Import Licences," line 4, read "barytes" in lieu of "pyrites."

NEWS AND NOTES.

CANADA.

Production of Helium in Alberta.—After several years' experimental work at Calgary, a plant has been erected in that city for the separation of helium from the natural gas of the Alberta fields; its capacity is 15,000 cub. ft. per 24 hours and the cost of production is estimated at 24 cents per cub. ft.—(*Oil, Paint and Drug Rep., June* 30, 1919.)

SOUTH AFRICA.

The Natal Cane Sugar Industry.—The Natal sugar industry made a poor start owing to lack of sufficient capital and adequate technical experience. At the present time, however, the majority of the 35 central factories is furnished with up-to-date machinery and many are capable of crushing 200—300 tons of cane per half-shift of 12 hours. The cane ripens about 21 months after planting, which takes place between September and November. Three crops are generally taken. On fertile land the first crop is calculated to give at least 3¼ tons of sugar per acre, and succeeding crops not less than 1½ tons. Natal is now able to meet almost entirely the sugar requirements of the South African Union. The total production has, in recent years, been (tons):—1908, 35,000; 1913, 96,000; 1917, 114,000; and 1918, 115,000. Owing to more stringent immigration laws Indian labourers are being replaced by the less reliable Kaffirs. Although the production of sugar is increasing and prices are rising, there has been a feeling of unrest on the South African sugar market owing to the possibility of Mauritius making an attempt to flood the South African market with 60,000 tons of sugar which has been left on hand owing to want of shipping for export.

AUSTRALIA.

Mining in South Australia.—Marked activity is being shown in mining operations in South Australia; the production for 1918, valued at £1,451,498, nearly equals that of 1917 and compares with an output 10 years ago valued at £413,390. The value of the manganese ore raised in 1918 (£17,000) was ten times that of 1917. Other values for 1918 are: Copper, £828,556; ironstone, £277,279; salt, £177,038; limestone, £34,813; gypsum, £28,012; flint, £11,849; phosphate, £10,773; silver-lead ore, £10,161. Some rich copper ore discovered near Broken Hill yielded copper valued at £859 from 33¼ tons, after deducting 20*s*. a unit for freight and smelting charges.—(*Bd. of Trade J., July* 3, 1919.)

Queensland.

Manufacture of Roofing Tiles.—The manufacture of roofing tiles, a comparatively new industry to Australia, has been extended to Queensland, a works having recently been established at Riverview by the Terra Cotta Roofing Co. Ltd. The texture of the tiles, now being made in small quantities, is considered to be equal to, and the manufacture in one respect (harder burnt) superior to, the previously imported article; they are considered to be especially adapted to Queensland, *i.e.*, they are hard, medium coloured, strong, and provided with the standard grooves and lips that have proved so efficient in the past. Tests warrant the belief that the Queensland tile will keep its original colour. With the delivery of modern machinery it is expected that employment will be found for a considerable number of hands.—(*Industrial Australian, Feb.* 13, 1919.)

Flax Cultivation.—The Queensland Department of Agriculture is making inquiries with a view to securing supplies of flax seed (linseed) for prospective Queensland growers. The Commonwealth Flax Industry Committee emphasises the fact that the production of fibre flax requires a rainfall of at least 30 in. per annum, with regular incidence, a moist spring, and preferably cloudy skies—conditions which are met with in parts of Tasmania, Victoria, and New South Wales. For the present the supplies of seed will be required for these States. The Committee has recommended that experimental plots be established in districts in Queensland, where the above climatic conditions prevail, and that, should the result of the experiments be satisfactory, it may warrant the cultivation next year of fibre flax in Queensland on a commercial basis. Consideration is being given by the Committee to the supply of seed.—(*Industrial Australian, Feb.* 20, 1919.)

NEW ZEALAND.

State Forestry.—The report on State Forestry in New Zealand for the year 1917—1918 deals with the forest situation in the Dominion under Part I.—"State Nurseries and Plantations" and Part II.—"Native Forests."

In Part I. it is shown that during the year 6,822,700 trees were raised at State nurseries, 4,725,547 were sent out to plantations, and 530,458 to outside lands. The total area planted during the year was 2653 acres, making the total area under plantation 32,645 acres.

In Part II. the output of native timber from the Dominion sawmills is given as approximately 247,980,000 super. feet, or 104,520,000 super. feet less than for the preceding year. This output includes 20,890,359 super. feet of native kauri and 1,000,000 super. feet of *Pinus insignis* and eucalyptus timber grown by planting. The export of native timber amounted to 70,747,737 super. feet and the import of exotic timber to 12,864,363 super. feet.—(*Australian Forestry Journal, Jan.*, 1919.)

UNITED STATES.

Standardisation of Dyes, etc.—One of the New York laboratories is initiating extensive work in standard dye tests, the service being particularly useful in export trade. The yarn dyed with the sample is sent to the purchaser with a certificate on which the method of dyeing is described, and the dye is shipped direct from the testing laboratory after sampling. It seems evident that under such conditions the export of American dyes should be greatly facilitated.

A fellowship has just been established at an American university by a large paint manufacturer for the investigation of the measurement and standardisation of colour. The same problems are being studied in the research laboratories of a maker of photographic materials, who is installing a colour-measuring apparatus at a cost of $2500.

New Method of Investigating Metal Stresses.—The use of the motion-picture camera in conjunction with the microscope has recently given most interesting data in a series of tests on metal stresses. The change produced by repeated bending of iron in a bending machine up to the breaking point was successfully recorded and each change in structure faithfully reproduced upon the film and screen. Ultimately it will be possible to tell how far a given specimen has progressed toward its breaking point by comparing its crystalline structure with a film of the same material, and thus know in advance what replacements must be made for the sake of safety. Such records will also be helpful in heat-treating practice.

Report on European Dyestuff Situation.—An oral report on the dyestuff situation in Europe has been presented to the U.S. Secretary of Commerce and to the President of the Chemical Foundation by

Mr. Wigglesworth, who, as trade commissioner to the Department of Commerce, recently spent three months on a survey of conditions in England, France and Italy. He recommends the adoption in the United States of the English licensing system, now being favourably considered by France and Italy, as it appears to be adequate to meet any unforeseen conditions which may arise.—(*U.S. Com. Rep., June* 11, 1919.)

Sulphur Deposits in Texas.—The Acting British Consul reports that the Texas Gulf Sulphur Co., which is developing the sulphur bed at Gulf, Texas, has attained a production of 1200 tons a day and has signed contracts to export up to 200,000 tons a year from Texas City, where the wharfage rate on sulphur is only 20 cents per gross ton. Electrically-operated shovel cranes will unload the cars into bins and thence into the ships, of which three, each of 5000 tons, will be in service every month.—(*Bd. of Trade J., July* 3, 1919.)

JAPAN.

A Chemical Investigation Society.—Japanese chemical industries experienced a wonderful development during the war, but the restoration of peace has shown that the position of many of them is by no means stable. With the object of helping those branches which are in a bad position and of stabilising others which need support in view of prospective foreign competition, Prof. T. Takamatsu and others have founded the Chemical Industry Investigation Society under the auspices of the Chemical Industry Association. The Society has undertaken, in the first place, an immediate investigation of the position of the following groups of substances: I. Heavy chemicals and electro-chemical products; II. Coal-tar products, distillation products and drugs; III. Paints and pigments; IV. Glass; V. Rubber; VI. Fats, oils, soaps and waxes; VII. Celluloid. Each group has its own special committee which is charged with devising means of relief. The following is a summary of the recommendations arrived at up to June, 1919:—

I. (a) The rate of import duty on potassium chlorate should be 5 yen per 100 kin (=0·9*d*. per lb.); potassium chloride should be duty free. (b) The import duty on caustic soda should be raised to 25 per cent.; the price of salt sold by the Salt Monopoly Bureau should be reduced to 40 sen; and the Government should encourage the exportation of bleaching powder by granting a bounty of 1 yen per 100 lb. (c) The cost of manufacture of soda ash in Japan will be 115·77 yen per ton (£11 16*s*. 4*d*.); its future should be assured provided adequate help is received from the Government.

II. (a) The import duty on dyes, drugs and their intermediate products should be 50 per cent. *ad valorem*; and on raw materials, *e.g.*, benzene, methyl alcohol, 25 per cent. (b) Factories owned or controlled by Government should not manufacture any products which are being produced by private firms. (c) The Government should grant special facilities in regard to exportation and freight.

III. If import duty is to be levied on lead and zinc, it should be refunded when these are used for paint and pigment manufacture.

IV. (a) Freights to India should be so lowered as to enable Japanese glassware to compete with European in that country. (b) Importation of soda ash should be duty free. (c) Import duty on sheet glass should be doubled, at least, and firebricks should be admitted free. (d) Freights on exported window glass should be greatly reduced.

V. No definite conclusions have yet been reached, but the committee agrees that raw materials and perfumery should be free of import duty, but fatty acids, paraffin wax, glycerin and dynamite should be highly taxed.

The Chemical Industry Association is extending its activities by arranging for popular lectures on the chemical industries to be given in twenty-three different towns during the next five months. (kin=1⅓ lb.; yen=2*s*. 0½*d*.; sen=·01 yen.)

GENERAL.

The Character of Derbyshire Oil.—Further and more detailed analyses of the oil obtained at the Hardstoft boring have been made by Mr. J. E. Hackford. In addition to the data already published (this J., 1919, 201 R), the viscosity has been determined at various temperatures, the flash point (Abel closed) is 35°F., the ash content 0·036%, and the calorific value 20,290 B.Th.U. Distillation tests show that the crude oil will yield 4·5% aviation spirit, or 7·2% first grade commercial spirit, or 10% commercial motor spirit. The kerosene fraction varies from 30—40%. A sample representing 33% of the crude oil had:—Sp. gr. 0·783, flash point (Abel closed) 135° F., colour-water white, and sulphur 0·08%. The quality of the gas oil was also very good. The percentage of lubricating oils obtained was 30, the sp. gr. 0·893, ash 0·01%, and viscosity, R.I., 3736 secs. at 140° F., 328 secs. at 180° F., and 172 secs. at 212° F.

Patents, Trade Marks and Designs in Relation to the Terms of Peace.—During the period of the war numerous patents have gone void in the countries of the high contracting parties through the non-payment of fees, or non-working, or non-fulfilment of various formalities. All these can be revived within one year of the Treaty coming into force on payment of the regular fees due in the interim, and without extra fines or payment, but always without prejudice to the rights of third parties acquired in the meantime. Any patent which could have been filed during the war to claim rights under the International Convention, but which for any reason whatsoever was not so filed, can now be filed during the six months after the Treaty coming into force, but again without prejudice to the rights of third parties acquired in the meantime, so that apparently any person having got to work on such defaulted patent during the interim can continue to infringe even though the patent be renewed to the original inventor.

In Continental European countries these patents will date from the day of application in those countries, but with priority date as of the date of the original application in the country of origin. In the United States and Canada they will date from the day of grant of the application after allowance, while in Great Britain, Australia, New Zealand and South Africa, they will date from the day of application in the country of origin, unless a new legislation changes this.

Each of the Allied Associated Powers reserves to itself the right of imposing such limitations, conditions or restrictions on rights thus granted (except in the case of trade marks), or which may subsequently be acquired, in accordance with its legislation, by German Nationalists, "whether by granting licences or by the working, or by preserving control over their exploitation, or in any other way as may be considered necessary for national defence or in the public interest, or for assuring the fair treatment by Germany of the rights of industrial and literary property held in German territory by its Nationalists, or for securing the due fulfilment of all the obligations undertaken by Germany in the present Treaty, but the rights thus reserved by the Allied and Associated Powers shall only be exercised in cases considered necessary for national defence of the public interest." The pro-

visions of this article shall not apply in the case of businesses or companies liquidated under war legislation by the Allied or Associated Powers.

From this it would appear that even those patents which have been deliberately allowed to go void by their owners during the war can now be resuscitated for the remainder of the period of grant. This at first may seem unfair, but on the other hand it would be still more unfair to natives of a country if foreigners could renew their rights while they themselves could not.

The Treaty is reciprocal as regards patents and trade marks with the exception above stated, and we are able now to obtain patents and pay the fees on them in the enemy countries.

Explosives and Poisons in Relation to the Peace Treaty.—Article 172 of the Peace Treaty enacts that within three months of the treaty coming into force the German Government shall disclose to the Allied Governments the nature and mode of manufacture of all explosives, toxic substances or like chemical preparations used, or prepared for use, by Germany during the war.

Italian Chemical Federal Council.—An Italian Association for General and Applied Chemistry (Associazione Italiana di Chimica Generale ed Applicata) has been recently established with temporary offices at 89B, Via Panisperna, Rome. The officers for the current year are:—President, Prof. G. Ciamician; Vice-Presidents: L. Parodi Delfino, A. Menozzi; Council: Prof. F. Garelli, P. Ginori Conti, Prof. R. Nasini, Prof. A. Piutti, U. Pomilio, F. Quartieri, Dr. A. Ricevuto, Prof. R. Salvadori, Dr. O. Severini, Prof. V. Villavecchia. Finance Committee: Prof. P. Biginelli, G. Bracchi, Prof. G. Fabris. Prof. Domenico Marotta is the acting general secretary. The Association is to publish a journal dealing with industrial chemistry, trade matters, education, etc.

An Iron Industry for Holland.—It has now been definitely decided to erect two or three blast furnaces near Ymuiden on a site connected by rail and canals with the main lines of communication, and it is intended at a later date to increase the number to six and, possibly, to instal electric furnaces also. The output of the blast furnaces will be 250 tons each per day. There is to be a Martin furnace with a daily output of 600 tons, rolling mills with an output of 500 tons per day, and two batteries of coke ovens with 60 ovens per battery. The necessary arrangements are being made for the utilisation of the by-products. Slag will either be converted into cement or utilised in the manufacture of bricks, for both of which there is a great demand in Holland. It is expected that the sale of these by-products will reduce the cost of production to such an extent that German competition need not be feared. Meantime, temporary works will be established containing two or three Martin furnaces with a total production of 60 to 80 tons per day. There will also be a small rolling mill producing bars and angles, with a calculated output of 150 to 200 tons per day. It is stated that the necessary arrangements have been made with the Netherlands Government for the supply of coal from the State mines.—(*Board of Trade J., June* 26, 1919.)

War Damage in Belgium.—The *Information Belge* states that the Central Industrial Committee of Belgian Manufacturers has assessed the total value of industrial damage done during the war at 9,287,000,000 francs (about £371,500,000). Among the items specified and the value of damage done, in millions of francs, are:—Mining and quarries 993, zinc and copper 496, iron and steel 1107·5, ceramic 229·5, glass 154, chemicals 229·5, textiles 2198·5, hides and skins 718, and paper, pulp, etc. 69·5. Values are assessed on prices as at end of April 1919.—(*Bd. of Trade J., July* 10, 1919.)

Resources and Industries of the Christiansand District (Norway).—Mineral deposits of nickel, molybdenum, and felspar have been prospected and feverishly worked during the war. The output of refined nickel at Saetersdal now amounts to 75—100 tons per month, while the refining plant at Vennesla, owned and operated by British capital, shipped over 2500 tons of aluminium to England during 1917. Six tons of molybdenum glance was exported in 1917, probably to England. Deposits of this mineral near Mandal were worked during 1917 and the concentrates shipped to England, but the official figures are not available. The district contains a number of large tobacco factories which in 1917 imported over 260,000 lb. of leaf, 96 coming from America. There is abundant water-power awaiting development, recent estimates placing the total available quantity at 1,000,000 h.p. The chief exports from the port of Christiansand in 1917 were (metric tons):—Aluminium 2540, felspar 635 (to Germany); nickel 311, sodium nitrite 300, paper 1741; also 7327 standards of timber, and 64,330 cub. ft. of wood pulp.—(*U.S. Com. Rep. Suppl., May* 15, 1919.)

Use of Fertilisers in Denmark.—Danish agriculture is carried on with a very high degree of efficiency. The farmers are well versed in the scientific use of fertilisers, and take a special interest in obtaining the largest possible return from their land. The following table shows the yields (in bushels per acre) compared with the corresponding yields obtained in America:—

		Average 1909—1913	1917	1918
Wheat	Denmark...	44·5	32·8	45·0
	U.S.A. ...	14·7	14·2	15·6
Rye	Denmark...	28·6	20·5	23·5
	U.S.A. ...	16·1	14·7	14·1
Barley	Denmark...	42·4	27·7	39·0
	U.S.A. ...	24·3	23·7	28·9
Oats	Denmark...	48·4	30·8	44·4
	U.S.A. ...	30·6	36·4	34·5
Potatoes	Denmark...	210·0	225·0	214·0
	U.S.A. ...	97·0	100·8	not stated

There was a decline in yields during 1916 and 1917 owing to the shortage of fertilisers, and the recovery in 1918 is attributed to the unusually favourable weather.

All manures are applied in the elementary forms of superphosphate, nitrates and potash, and there is no market for mixed or special compound manures. During the war supplies became so short that the Government took over the distribution. The import returns show that phosphates fell from over 200,000 tons in 1914 to 19,000 tons in 1917, and to zero in 1918. Chilean nitrate similarly dropped from 42,000 tons in 1914 to 116 tons in 1918, but synthetic nitrate from Norway increased from 11,000 tons in 1914 to 19,000 tons in 1918. Potash supplies (from Germany) increased from 23,000 tons in 1914 to 33,000 tons in 1918. If prices are not prohibitive, it is expected that greatly increased quantities of fertilisers will be used in the next few seasons to make up the deficiencies of recent years.

The home manufacture of superphosphate, as well as a large part of the dealings in nitrates and potash, is in the hands of the Danish Fertiliser Co. (generally known as the Fertiliser Trust), which has practically a monopoly. The Trust has several superphosphate plants, the total annual capacity of which is nearly 200,000 tons. The farmers' associations have recently formed a co-

operative society for the purpose of buying and distributing fertiliser supplies, and this association is expected to import over 150,000 tons of superphosphate and to become a formidable rival to the Trust. Importers are very anxious to get quotations for early delivery of superphosphate.—(*U.S. Com. Rep., May* 23, 1919.)

Cadmium in the U.S.A. in 1918.—The United States produced, in 1918, 127,164 lb. of metallic cadmium and 51,702 lb. of cadmium sulphide, the average prices per lb. being \$1·48 and \$1·36 respectively.

The cadmium of commerce is derived from zinc minerals and ores, the average content being in the ratio of about 1 of cadmium to 200 of zinc. A separation is effected by the higher volatility of cadmium in the distillation of zinc, the first fractions containing a greater proportion. Another important source is the fumes from lead blast furnaces. It is hoped that electrolytic zinc-plant residues will soon be supplying about one-third of the production.

Cadmium is used in easily fusible alloys and some aluminium solders. The addition of 1 per cent. of cadmium to lead improves the coating property of lead on iron.

Owing to the scarcity of tin an investigation was made on the possibility of substituting cadmium, and a satisfactory solder was made consisting of 80 parts of lead, 10 parts of tin and 10 parts of cadmium. An investigation of its toxic properties is proceeding with a view to its use on food containers. The use of lead-cadmium solders is complicated by the ease with which cadmium oxidises, but the addition of tin or zinc appears to reduce the tendency. The higher price of cadmium is offset by the smaller quantity required in the alloys.

The use of cadmium sulphide as a permanent pigment is well known; it is also used to give colour and lustre to glass and porcelain. There appears to be some possibility of using cadmium, as a primary coat, for rust prevention in electro-plating. —(*U.S. Geol. Survey, May* 1919.)

Raw Materials of the German Printing Industry during the War.—After the outbreak of war the necessity of finding substitutes for resin, turpentine, linseed and other oils, soot and lamp black, products mainly obtained from America, soon became apparent. Existing supplies of resin and oils were commandeered for military purposes, and all linseed oil was earmarked for edible purposes. The good results expected from the winning of resin from Russian Poland did not materialise, as the pine resin obtained was not suitable for the printing industry. The substitution of a suitable product for resin was partly overcome by means of coumarone resin ("acid tar"), which was obtained from the heavy benzol fraction by treatment with concentrated sulphuric acid. The production of coumarone resin was carried out with good results at practically all the coke-ovens and benzol works in the country. There are about thirty sorts of this resin prepared, from pale elastic to liquid black varieties, and, although they are not complete substitutes for resin, they have greatly helped in the printing trade and will doubtless be used in the future. The large number of artificial resins obtained by the condensation of phenols and aldehydes found little application, mainly on account of their sparing solubility in the solvents used in the printing pastes. Petroleum pitch, of Austro-Hungarian source, has been used as a substitute for resin. It has been still more difficult to find substitutes for linseed and wood oils, etc. Blown or oxidised marine oils were only available in the early days of the war. The printer had to be content with light-coloured coumarone resin and suitable solvents, *e.g.*, a petroleum distillate was used in place of turpentine. Great difficulty was experienced in finding a substitute for glycerin for making book printing paste; glycol was found to be satisfactory, but little was obtainable. The finest qualities of soot and lamp black, particularly of "flying soot," could not be replaced, and good lamp black could not be prepared for lack of suitable oils. Mineral oils, previously obtained from America, were soon exhausted, the supply from Galicia and Rumania failed temporarily, and the home production was scarcely worth consideration. Only small quantities of spindle oils were procurable, and the refined sorts have long since been unobtainable. As substitute for these oils, a coumarone resin of liquid consistency was used, generally along with tar oils, the latter always being obtainable in sufficient quantities. The use of such products for printing purposes gave the newspapers an unpleasant odour. Although the greatest efforts were made to keep the printing trade in full activity owing to its extraordinary value from a political point of view, coumarone resin was practically the only thoroughly satisfactory substitute evolved.—(*Z. angew. Chem., Feb.* 28, 1919.)

The Institute of Chemistry.—In the July examinations for the Associateship of the Institute one candidate passed in mineral chemistry: Lieut. C. W. Wood, King's College, London; two candidates passed in organic chemistry: L. G. Peirson, B.A.(Cantab.), and J. E. Pollock, B.Sc.(Lond.), University College, Reading; and one in chemical technology, with textile chemistry as special subject: P. E. Stanhope, Royal Technical Institute, Salford.

WORLD'S PRODUCTION OF CALCIUM CYANAMIDE.

—	1918 Productive capacity of works completed or under construction	1918 Actual production	1917	1916	1915	1914	1913
			metric tons				
Germany	600,000	300,000	400,000	500,000	500,000	36,000	24,000
Austria-Hungary	30,000	24,000	24,000	24,000	24,000	24,000	7,500
France	300,000	100,000	100,000	100,000	80,000	7,500	7,500
Italy	80,000	15,000	12,300	25,105	25,292	15,556	14,982
Norway } Sweden }	200,000	200,000	200,000	26,409	25,000	14,670	22,110
				18,000	16,363	18,000	18,352
Switzerland	65,000	40,000	40,000	29,500	12,500	7,500	7,500
Canada } United States }	58,000	58,000	58,000	58,000	58,000	58,000	48,000
Japan	101,605	50,000	50,802	33,462	30,278	11,171	7,000
Total production	1,434,605	787,802	885,102	814,476	771,433	192,397	156,944

(*Internat. Inst. Agric., May,* 1919.)

PARLIAMENTARY NEWS.

HOUSE OF COMMONS.

Sale of Linseed Oil to Germany.

Captain Brown asked if the President of the Board of Trade was aware of the allegation that while Belgium is paying £120 per ton for linseed oil, the British Government is selling it at £75 per ton to Germany.

Mr. McCurdy, in reply, stated that in accordance with the arrangements made at the Brussels Conference, 25,000 tons of linseed oil were sold to Germany at £78 per ton. When this price was fixed the oil could be bought in this country at £58 per ton, and Belgium had declined to purchase any part of the British surplus.—(July 8.)

Answering another question by the same member, Mr. Roberts said that the quantity of linseed oil delivered to Germany under the agreement of March 31, 1919, was approximately 12,000 tons, and that no further agreements have been entered into. —(July 11.)

Importation of Silica.

Mr. Seddon inquired whether the decision to allow unrestricted importation of silica ground and silica sand would be permanent, and if the President of the Board of Trade were aware that many members of the Flint and Silica Fleur Manufacturers' Association laid down expensive plant during the war in order to make the country self-supporting. Mr. Bridgeman replied that the Board of Trade was not prepared to prohibit the importation of these important materials.—(July 14.)

Pithead Prices of Coal.

In answer to Sir W. Davison, Mr. Bridgeman gave the following average prices per ton of coal at the pithead for the latest periods for which particulars are available:—Scotland (including 6*s*. increase), 28*s*. 11*d*.; rest of Great Britain, 29*s*. 4*d*.; Transvaal, 1918, 5*s*. 6*d*.; Natal, 1918, 10*s*. 7*d*.; India, 1918, 5*s*. 10*d*.; U.S.A., June 1919, 11*s*. 2*d*.; France, June 1919, 36*s*.; Belgium, 1917, 18*s*.; Spain, 1917, 39*s*. The average price of pithead coal in the United Kingdom in 1913 was 10*s*. 1¼*d*. per ton.—(July 14.)

Patents and Trade Marks Bills.

Bills to amend the Patents and Designs Acts and the Trade Marks Act, 1905, were introduced by the President of the Board of Trade, and read a first time. The former proposes, *inter alia*, to extend the life of patents, including those expiring before January 1, 1920, and of licences granted under them, from 14 to 16 years; any loss or liability in respect of contracts made with the patentee before November 19, 1917, to be adjudicated upon by the Court. Product patents of a chemical, medicinal or dietetic nature are to be abolished as from the passing of the Act.—(July 15.)

The Coal Mines Bill.

Major Baird, Under-Secretary to the Home Office, moved the second reading of this Bill, which gives effect to the promise made by the Government to adopt the recommendations of the Sankey Commission in regard to the substitution of a seven-hours day for an eight-hours day. The Bill was read a second time.—(July 17.)

Coal Production.

Sir A. Geddes informed Mr. Houston that in 1916, the latest year for which a complete comparison is available, the output of coal per person employed per year was for the United Kingdom 265 long tons, and for the United States 800 long tons. In reply to Captain Bowyer he gave the following figures of production for the United Kingdom during the 24 weeks ended June 22, 1918, and ended June 21, 1919:—Outputs, 109,046,000 and 110,652,000 tons; average numbers of workers employed, 972,000 and 1,112,000, respectively.—(July 21.)

Beet Sugar Factory.

In answer to Sir J. D. Rees, Sir Arthur Boscawen stated that the Government had decided in principle to give assistance to the British Sugar Beet Growers' Society by means of an advance of part of the capital required, and a guarantee of interest for a certain number of years on the remainder of the capital, up to a fixed amount. The exact terms and conditions of the assistance to be given are now under consideration.—(July 21.)

Japanese Imports into India.

Mr. Montagu, replying to Captain Ormsby-Gore, said the total value of imports into India from Japan was £3,187,000 in 1913-14, £2,966,000 in 1914-15, and £22,404,000 in 1918-19. Only a small proportion of these imports were not manufactured goods. —(July 21.)

REPORT.

Reports by the Coal Industry Commission. *Second Stage.* (*Cmd.* 210, 4*d*.) *London: H.M. Stationery Office.*

1. The Chairman (Mr. Justice Sankey) recommends the immediate purchase of coal royalties by the State; at present there are difficulties in working and waste of coal due to the multiplicity of owners, irregularity of boundaries, barriers left between different properties and lack of co-operation in drainage. The value of each property should be assessed by Government valuers, and Parliament should consider the fixing of a maximum sum to form a pool to be allocated between the various royalty owners. He further recommends that the principle of State ownership of the coal mines be accepted, so that co-ordination of effort in respect of production, export, and inland supply may be attained; this is necessary owing to the unique position of the industry. Consumers are entitled to have a voice in the production and selling of coal; at present there is underselling in the export trade and overlapping in the inland trade. Under State ownership the waste due to lack of capital in some mines and improper management in others would be obviated, and standardisation of materials and appliances would be possible. In view of the attitude of the workers and of the colliery owners, nothing short of State ownership will achieve the desired results. In addition to collieries and accessory plant, composite undertakings should be purchased unless the severance of the undertaking can be commercially effected; the question of leaving the coke and by-product industry in private hands remains to be considered. It would always be possible to lease a mine or group of mines or a composite undertaking. A scheme for local administration is outlined which it is recommended should be immediately set up and worked for three years, after which the mines should be purchased.

2. Sir L. C. Money and Messrs. Hodges, Smillie, Smith, Tawney and Webb are in substantial agreement with the above report but recommend a greater share in administration for the workers, and State ownership of coke and by-product plant attached to collieries. Messrs. Hodges, Smillie and Smith do not agree to compensation for mineral owners (except for small owners).

3. Sir A. Nimmo, Sir A. M. Smith and Messrs. Balfour, Cooper and Williams recommend the acquisition by the State of all coal seams subject

to existing leases, but strongly oppose the nationalisation of the coal mining industry owing to the ineptitude of Government Departments for managing an industry and to the danger due to political influence. They do not consider it proved that nationalisation would cheapen coal or prevent strikes, but conclude that it would be detrimental to the development of the industry and to the economic life of the country. The fall in output should be immediately investigated and any proposal affecting the nation as a whole or giving preference to any class be referred to the community. Suggestions are made for improvements in safety, housing, etc., and a scheme of administration providing for the representation of workers on Pit Committees is outlined. Local authorities should be given power to deal in household coal in open competition, and consolidation of distributing agencies should be effected without forming harmful trusts. A committee of owners, miners, consumers and distributors should meet to consider points of common interest.

4. Sir A. Duckham recommends the acquisition of mineral rights and the granting of leases to amalgamated mining interests in definite areas to be defined. Such amalgamations (District Control Boards) should issue shares to the value of the various interests based on 1914 prices, and carrying a guaranteed 4 per cent. dividend with a further 2 per cent. if earned; two-thirds of any further profits must be used to reduce the price of coal. Provision is made for a bonus on output for workers and a bonus on profits for staff. Each Board of Directors would contain at least four elected by shareholders, one staff and two workers' representatives. Composite undertakings would work their own collieries under lease, but would only sell coal as such through the District Board.

GOVERNMENT ORDERS AND NOTICES.

NEW ORDERS.

THE COAL (PIT'S MOUTH) PRICES ORDER, 1919.

BOARD OF TRADE, JULY 12.

This Order makes provision for an increase of 6*s.* per ton in the pithead price of all coal despatched from collieries on or after July 16 for consumption in the United Kingdom, and for an automatic increase of the same amount in the retail prices of house coal. The minimum prices of coal, coke-oven coke and patent fuel for export and for ships' bunkers have also been increased by 6*s.* per ton. This increase in the minimum prices applies to all cargoes and bunkers, the loading of which is commenced on or after July 16, 1919, and involves increases of all prices of coal, coke-oven coke and patent fuel for export and bunkers which are at present less than 6*s.* above the existing schedule price.

The Coal (Pit's Mouth) Prices No. 2 Order, 1919, issued by the Board of Trade on July 15, postponed the coming into operation of the above Order until a later date to be determined.

The Coal (Pit's Mouth) Prices No. 3 Order, 1919 (Board of Trade, July 18), enacts that the original Order shall come into force on July 21.

A White Paper issued by the Board of Trade on July 11, shows the basis upon which the increase of 6*s.* per ton is calculated. The estimated deficiency on the working of the coal industry for a period of twelve months from July 16 last is £46,600,000.

The Controller of Coal Mines has issued an Order for the substitution of sea-borne coal from Durham and Northumberland for rail-borne coal which has been supplied during past years from Yorkshire and the Midlands. This Order applies to gas companies, power stations, and users generally of manufacturing coal as from August 1.

ORDERS CANCELLED.

The Army Council has issued a schedule of Orders, dating from 1917, and relating to leather, etc., which are cancelled as from June 30, 1919.

EXPORTS.

The Board of Trade (Export Licence Department) has issued, in the *Board of Trade Journal* of July 10, a number of special export regulations applicable to countries in Europe and on the Mediterranean Sea.

Trade with Germany etc.—General licences are now issued authorising, with certain reservations, the resumption of trade with Germany and German-Austria. No licences are required for the export of goods included in list C.

Re-exportation of Imported Chemicals.—We are officially informed by the Board of Trade, Department of Import Restrictions, that firms desiring to import chemicals on the prohibited list in transit, pending re-export, should make application to that Department giving full particulars of the transaction, together with country of origin and destination. Such firms will then be sent a form of bond, on completion of which the import will be authorised. The bond will be discharged on proof of export, by means of, for example, either a bill of lading or a certificate issued by the Customs containing sufficient particulars to identify the exported goods covered by the bond.

IMPORTS.

The Department of Import Restrictions has issued general licences allowing importation of the following materials:—

Acetate of iron; acetate of lime; acetone; adalin; alum; aluminium acetate; aluminium sulphate; ammonia (hydrate), carbonate, chloride, chlorate, nitrate, phosphate, sulphate; baryta; bleaching powder; boracite, borate of lime; borate of manganese; borax; boric acid; brimstone; calcium carbide; carbon bisulphide; carbonic acid; chloroform; chromic acid; cinchonic salts; cinchonidine salts; citrate of lime; citric acid; copper sulphate; cream of tartar; Epsom salts; ether; ferrous sulphate; formaldehyde; fusel oil; gelatin, photographic; glycerin; hydrochloric acid; hydrofluoric acid; iodine; lactic acid; lead acetate; lead nitrate; lithia carbonate; magnesia; magnesium chloride; magnesium sulphate; manganese dioxide; menthol crystals; mercurial salts; methylethylketone; nitric acid; oxalic acid; phosphoric acid; picric acid; quinidine salts; quinine salts, other than sulphate; quinoidine; sal acetos; soda ash; soda, aluminate, bicarbonate, caustic, chloride, crystals, nitrate, nitrite, silicate, sulphate, sulphide; Stovaine; sulphuric acid; tartar emetic; tartaric acid.

The Board of Trade announces that Consular certificates of origin and interest will no longer be required to be produced in respect of goods imported into the United Kingdom.

Sir Evan Jones has resigned his position as Commissioner of Dyes. All communications referring to dyes should now be addressed to the Assistant Secretary, Industries and Manufactures Department, Board of Trade, Gwydyr House, Whitehall, London, S.W. 1.

OFFICIAL TRADE INTELLIGENCE.

(*From the Board of Trade Journal for July* 10 *and* 17.)

TARIFF. CUSTOMS. EXCISE.

Argentina.—A decree dated May 17 controls the import and sale of opium and its preparations, morphine and its salts, cocaine and its salts and Indian hemp. Importation by druggists is only permitted with the concurrence of the Department of National Health. The Department may cause an analysis of the goods to be made before importation is allowed.

Australia.—The application of the new regulations affecting the import of rubber-covered wire has been postponed until January 1, 1920.

French Colonies.—The prohibition of the import of sugar and alcohol is extended to all French possessions except India, Tunis and Morocco, as from July 8.

Japan.—The restriction on the export of the following articles was removed on May 23:—Caustic soda, soda ash, borax, rubber, copra, coconut oil, chrome, ferro-chrome, chrome steel, tungsten, tin, molybdenum, nickel manganese cobalt and their ores, tin chloride, tin plate, ferro-nickel, ferro-cobalt, spiegeleisen, ferro-manganese, ferro-tungsten, antimony, Chile nitrate, cyanides of soda and potash, mica and plumbago.

Luxemburg.—The new provisional customs tariff affects, *inter alia*, sodium chloride, sugar, vinegar, acetic acid, wines, spirits and tanning extracts.

Netherlands.—The prohibition of the export of potable spirits and odoriferous substances has been withdrawn as from July 2.

New Zealand.—Certificates of origin and interest are now required in respect of goods imported from Belgium.

Portugal.—The surtax on imported "articles of luxury" affects skins, ivory, camphor, malt, yeast, essential oils, alabaster, marble, salt, chemicals, medicines, rubber, gutta-percha, alcoholic beverages, chocolate, preserves, glass, porcelain, toilet soap, gold, silver and platinum.

Rumania.—Invoices for goods shipped to Rumania do not require to be viséd by the Rumanian Government representatives in the country of export.

Russia (Northern Territory).—The temporary alterations in the rates of customs duties are set out in the *Board of Trade Journal* of July 17.

Sweden.—Export restrictions are now withdrawn on emery, polishing stones, unwrought lumber, iron sheets coated with tin, lead, etc., certain scientific instruments and mounted optical glasses.

Switzerland.—Exportation of the following substances is now permitted by general licence:—Gentian root, saltpetre, kaolin, calcium phosphate, fluorspar, quartz in powder, kieselguhr, silicate of alumina, emery, carborundum, ferro-alumino-silicon, saccharin, essential oils, perfumery, matches, colours, varnish, asphalt, firebrick, optical glass, aluminium, dye woods, tannin and many other chemicals.

Tunis.—Among the articles the export of which is still prohibited except under licence are oil seeds, vegetable oils, phosphate of lime, bauxite, petroleum, iron ore, gold, silver, platinum and pimento.

United States.—It is proposed to amend the customs duty on imported magnesite, ore, calcined and brick.

The Revenue Act of 1918 may be seen at the Department of Overseas Trade.

Venezuela.—Recent customs decisions affect linseed oil and sheet glass.

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 73, Basinghall Street, London, E.C. 2, from firms, agents or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

Locality of Firm or Agent	Materials	Reference Numbers
British E. Africa	Roofing material, paint, varnish	*
British India (Bombay)	Iron and steel products, galvanised sheets, lead, zinc, aluminium, copper and brass sheets and tubes, asbestos ...	—
"	Corrugated sheeting, galvanised iron	108
British W. Indies	Paints, oils, varnishes ...	1091
Canada	Drugs	112, 113
"	High-speed steel, etc. ...	152
"	Sanitary earthenware ...	†‡
New Zealand ...	Preserved food, fertilisers	117
South Africa ...	Galvanised iron, steel plates	156
" ...	Paints, colours	157
Austria (Trieste)	Fertilisers, paraffin ...	158
Belgium ...	Caramel, brewers' sundries	163
Czecho-Slovakia	Drugs	167
France	Vegetable and animal fibres, kapok	170
Greece	Soda, copper sulphate, paint, metals ...	172
"	Metals, glass, pottery ...	174
"	Soap	175
"	Chemicals, paper ...	176
"	Metals, glass, leather, paint	178
Italy ...	Chemicals, metals, minerals, fire-bricks ...	127
"	Chemicals, lubricants, paraffin, steel ...	‖1679
"	Chemicals, pharmaceutical products	‖1682
"	Metals	‖1685
"	Plateglass	‖1686
" ...	Metals, fertilisers ...	‖1688
"	Scrap metals	‖1689
"	Chemicals, dyes, paints	‖1693
"	Heavy chemicals, drugs, dyes, oils, gums, waxes	‖1700
"	Caustic soda, drugs, oil, paint, varnish, fertilisers	‖1701
"	Chemicals, dyes ...	‖1707, 1716
"	Chemicals, dyes, mineral oil, castor oil	‖1718
"	Fire-bricks, refractories	‖1723
Rumania ...	Iron, metals	131
" ...	Chemicals, drugs ...	184
Spain	Hides, oil seeds, jute ...	133
"	Drugs, lubricants ...	186
Spain, Portugal and N. Africa	Heavy chemicals, dyes, iron, steel, tinplate ...	136
Sweden	Chemicals, pig iron, tinplate	187
Argentina ...	Chemicals, cement ...	143
" ...	Ammonia, aniline, arsenic, carbide, caustic soda, tar oil, carbolic acid, cream of tartar, stannous chloride, ferro-manganese, ferro-silicon, pig iron, gum lac, pure tin ingots, steel, sulphur, sulphate of alumina, tinplate ...	§
Chile	Paint, oil, cement ...	144
Netherlands West Indies	Varnish, beeswax, turpentine, leather, leather cloth, glass, marble ...	146

* The Secretary, Statistical and Information Department, London Chamber of Commerce, 97, Cannon Street, E.C. 4.

† High Commissioner for Canada, 19, Victoria Street, S.W. 1.

‡ Canadian Government Trade Commissioner, 73, Basinghall Street, E.C. 2.

‖ The Secretary, British Chamber of Commerce for Italy, 7, Via Carlo Felice, Genoa.

§ The Argentine Legation, 2, Palace Gate, W. 8.

TRADE NOTES.

BRITISH.

Jamaica in 1917—18.—The Jamaica sugar industry has been greatly stimulated by the high prices prevailing and the favourable conditions for crop production. The sugar exported in 1917 was a record for the island, amounting to 32,000 tons. This is estimated to have realised £672,000. Important developments are anticipated in the industry, and immediate arrangements include the erection of three new sugar factories in St. Catherine. Improvements in growing are also receiving attention, and heavy demands are being made on the nurseries at Hope and Montpelier for supplies of improved varieties of canes.

The copra industry is being extended, and numerous drying plants are being erected in the coconut districts. The total production was adversely affected by the hurricane, but large numbers of young trees are now coming into bearing and a progressive increase is looked for in the exports of coconuts during the next ten years. The exports for 1917 amounted to 30 million nuts.

Very good prices were obtained for hides, orange oil, and honey. Logwood and its extracts were exported to the value of £540,000.

The values of the total imports and exports of Jamaica in 1917 are compared in the table with those in 1907. The source and destination of the imports and exports respectively are also given for these two years.

	Imports.		Exports.	
	per cent.			
Source or Destination.	1907	1917	1907	1917
United Kingdom ...	47·4	19·5	21·5	44·8
United States	43·6	70·1	57·2	28·1
Canada	5·5	6·7	7·6	15·1
Other Countries ...	3·5	3·7	13·7	12·0

Total values:—Imports: 1907, £2,914,013; 1917, £3,323,942; Exports: 1907, £1,992,007; 1917, £2,479,107.

The Deputy Island Chemist dealt with 1198 samples in 1917, being 210 more than in the previous year.

The present prospects for sisal hemp are most encouraging, high prices being obtained for small parcels of the fibre. About one million plants are now being established at the Lititz plantation to supply the requirements of the 900 acres available for cultivation of sisal on the island.—(*Col. Rep. Ann.*, No. 980, *Feb.*, 1919.)

FOREIGN.

The Foreign Trade of Hongkong in 1918.—The Hongkong trade and shipping returns for 1918, the first attempt by the Colonial authorities to furnish complete records of the trade of the port, although based merely on merchants' declarations and to be regarded therefore only as approximate estimates, contribute undoubtedly towards a better knowledge of Chinese trade.

The total value of the trade of Hongkong amounted in 1918 to £127,990,977, the main distribution of which is indicated in the following table:—

Source or Destination	Imports (£60,933,490)	Exports (£67,057,487)
	Per cent.	
French Indo-China	25	8·7
Japan and Corea	16·1	6·7
China and Formosa	15·4	55·2
U.S.A.	13·7	8·1
British Dominions, Colonies, &c.	13·3	11·3
United Kingdom	7·3	1·7

The 1918 returns do not give a correct idea of British trade with Hongkong and South China under normal conditions. The British cotton piece-goods manufacturer has held his own in spite of the increasing pressure of Japanese competition, and 73 per cent. of the machinery imported (£491,788, excluding electrical machinery) was British, but war conditions diverted the bulk of the trade in metals and hardware to America, and the Japanese have secured by far the largest part of the trade in "sundries." With the hold thus secured by American and Japanese products in the South China market the utmost energy and enterprise will be demanded of the British manufacturers and merchants if they are to enjoy their full share of the trade.

Glass.—Of the imports of sheet and plate glass, valued at £69,817, two-thirds came from Japan and the balance mainly from the United States. Goods of better quality than those supplied by the Japanese are in demand. Japan sent almost all the bottles (£59,286) and four-fifths of the glassware (£47,556) imported during 1918.

Chemicals and Drugs.—The principal imports were calcium carbide (£53,735), caustic soda (£44,297), and sulphuric acid (£30,969). About half the total imports came from Japan.

Dyeing and Tanning Materials.—Total imports: £350,104. The smallness of the import of aniline dyes (£6811, mostly from the United States) is ascribed to the unfamiliar British, American and Swiss packages and to real or supposed defects in quality, but nevertheless there is a great demand in China for good aniline dyes, especially for a fast indigo blue.

Metals.—Total imports £8,233,600.

	Per cent of Total Value.	Sources. Per cent.
Brass ...	2·0	Japan 50; U.S.A. 28·6; U.K. 7·2.
Copper ...	1·2	Japan 56·2; U.S.A. 18·1.
Iron and Steel ...	57·3	U.S.A. 80·5; Japan 5·8; U.K. 5·2.
Lead ...	2·4	Australia 60·3.
Tin ...	34·0	French Indo-China 91·1; Netherland Indies 6·0.
Zinc ...	0·3	
Sundries ...	3·0	

Minerals and Oils.—Imports: £893,518. Exports: £1,385,395, of which wolframite accounts for £1,267,789.

Nuts and Seeds.—Chiefly groundnuts were exported, of which America took shipments to the value of £329,596.

Oils and Fats.—Imports of kerosene: £1,606,452, three-fifths of which came from America and the balance from Sumatra, the Netherland Indies and the Straits Settlements. Four-fifths of the imported lubricating oil was of American origin. The largest export of vegetable oil was wood oil (£421,582), of which America took 62 per cent. and the United Kingdom 13 per cent.

Paints.—Total imports: £200,350, of which 30 per cent. came from the United Kingdom, 18 per cent. from the United States and 13·6 per cent. from Japan. Chinese merchants frequently prefer paints in liquid form ready for immediate use.

Some further information is summarised below:—

	Total Imports	Country of Origin.
Chinaware	£170,669	Japan 76%.
Leather ...	894,381	Straits Settlements (sole leather); Japan (manufactured articles).
Matches ...	700,622	Japan 98%.
Paper ...	580,237	Japan 67%.
Soaps ...	163,916	U.K. 42%; Japan 37%.
	Total Exports.	Importing Country.
Hides ...	£846.081	Straits Settlements 33%. U.K. 25%. Japan 25%. U.S.A. 3%.

(*Bd. of Trade J., July* 10, 1919.)

COMPANY NEWS.

BRITISH DYESTUFFS CORPORATION, LTD.

A prospectus has been issued by this company offering for subscription at par 2,500,000 seven per cent. £1 preference shares and 2,500,000 preferred ordinary shares of £1. The authorised share capital is £10,000,000, of which £1,000,000 is in deferred ordinary shares, and the remainder divided equally between preference and preferred ordinary shares. It is worthy of note that the Government has subscribed for £850,000 in preference and a like amount in preferred ordinary shares. Of the proceeds of the present issue, approximately £1,700,000 will be paid to the amalgamating companies (British Dyes and Levinstein) to enable them to pay off outstanding liabilities. The prospectus states further that the total consumption of dyes in the United Kingdom in 1913 was 45,000,000 lb., of which more than 38,000,000 lb. was obtained from Germany. The production of dyes by the amalgamating companies is now more than four times their pre-war production, and is increasing rapidly. The total share capital and reserves of the four largest German dye companies in 1913 was £9,886,518, and the total profits £2,499,592. The combined profits of Levinstein Ltd. and British Dyes Ltd. were, in 1915—16, £852,350; in 1916—17, £1,295,862; and in 1917—18, £1,307,512. The amalgamating companies have works at Tunbridge and Dalton (Huddersfield), Blackley and Clayton (Manchester), and Ellesmere Port, and at the present time employ nearly 300 trained chemists and over 6000 workpeople. It is proposed to add to the extensive plants now in operation and under construction, and to increase the output of dyestuffs.

"SHELL" TRANSPORT AND TRADING CO., LTD.

Sir Marcus Samuel, presiding at the annual general meeting on July 1, referred to the growing importance of the use of liquid fuel, particularly in view of the diminished output of coal. The world's production of liquid fuel is at present about 40,000,000 tons per annum, but a very large proportion of it was already placed before the shortage of coal became apparent. Hence the substitution of liquid fuel for coal is strictly limited and the call for economy is urgent. The position might be considerably alleviated by using oil in internal combustion engines instead of burning it directly. "Shell" motor spirit is now everywhere available and there is no likelihood of demand exceeding supply. When the experiments now being undertaken are completed, this motor spirit will be found to have a 15-20 per cent. greater mileage efficiency than any other on the market. In spite of a big increase in capital, the dividend is maintained at the rate of 35 per cent. free of tax, and £41,172 is placed to the reserve fund, which now stands at £1,000,000. These satisfactory figures reflect a successful year's trading, due mainly to selling in Eastern currency and increased output of crude oil. Two subsidiary companies—the Egyptian Oilfields Ltd. and the "Shell" Company of California have paid substantial maiden dividends. Notwithstanding the success of the former, a long time must elapse before Egypt can produce sufficient oil to cover its own requirements. The total cash reserves of the associated companies amount to £24,000,000, and the total sum written off by them for depreciation since 1907 exceeds £12,000,000.

BURMAH OIL CO., LTD.

In his review of the company's operations during 1918 at the annual meeting held on June 26, Mr. J. T. Cargill, chairman, referred to the great progress made by the Anglo-Persian Oil Co., in which the Burmah Company has an interest of 949,864 ordinary £1 shares, the remaining 2,000,000 shares being held by the Government. These shares, states the *Financial Times*, are valued in the market at £15 per share, but are understood to figure in the Burmah Company's balance-sheet at 2*s.* 6*d.*

Work in 1918 was chiefly directed by the exploitation of the Yenangyoung field in the Beme district, where a very rich sand was struck; but production is falling off rapidly—a common experience in this field. Nevertheless, there are ample reserves of oil on the company's lands. Results obtained outside Burmah have been less satisfactory. In India, one district has been abandoned after drilling to 2660 ft. at a cost of £40,000 without finding oil; in another, drilling was abandoned after sinking to 1300 ft., and in Assam operations have been abandoned owing to the poor quality of the oil, small production and the presence of much water. Operations in Trinidad have also proved disappointing, production having been hindered by difficulties connected with plant and labour. With regard to the finances, the capital has been increased from £1,905,500 by the capitalisation of reserves, and the dividend for the year is 30 per cent., free of tax, equivalent to 45 per cent. on the capital as it stood in 1917, when 32½ per cent. was distributed. During the past four years the company has paid over £4,000,000 in income tax and excess profits duty, and distributed £2,758,000 in dividends.

LAGUNAS NITRATE.

The report for the year 1918 shows a net profit of £32,900, compared with £54,400 for the previous year (capital, £900,000). The dividend is maintained at 2*s.* per share free of tax. No appropriation is made to reserve, which stands at £100,000, but the balance forward is increased from £894 to £14,924. The stock of nitrate at the end of the year was 136,000 quintals, of which over 80,000 quintals had been sold but not delivered. The production of iodine was discontinued early last year owing to the accumulation of stocks; nitrate is being extracted on a reduced scale but the oficina was shut down in December last.

At the annual meeting held on June 23, the chairman, Mr. R. E. Morris, referred to the Association of Producers formed last year, which fixes prices, controls sales and has agencies in many centres. Some 83 per cent. of the producers belong to this organisation, but remaining outside it are the very important Antofagasta Oficinas, controlled by the Antofagasta Company, the German and the American companies, the last named being deterred from joining by the Sherman law.

The Chilean Government, which has not recognised the Association, has already sold nitrate through the Antofagasta Co. to Holland and Spain, and it is reported that negotiations are taking place for a consignment of one million tons to a firm established in Belgium, on the basis of a selling commission of ½ per cent., the profit to be shared equally between the producers and the consignees, but the loss, if any, to be borne by the producers alone. Such interference is greatly to be deprecated.

AGUAS BLANCAS NITRATE.

In common with other nitrate undertakings, this company did less well in 1918 than in the previous year. The trading profits, including £13,824 from iodine, was £8500 less at £56,900, and the net profit £24,100 lower at £38,155. The remainder of the outstanding debentures has been redeemed, the reserve fund increased to £40,615, and the dividend on the ordinary shares is 10 per cent., as against

13 per cent. The division of the proceeds of the sale of land amounting to 15s. per share was not sanctioned until February 1919, so that this distribution does not appear in the accounts. It has now been paid and the issued capital reduced to £67,500. The nitrate sold amounted to 726,000 quintals, compared with 685,000 last year; the cost averaged 10s. 9d., as against 8s. 5·89d., and the sales 12s. 4·89d., against 9s. 8·13d. Extraction is proceeding, but manufacture has been suspended.

Proposed Amalgamation between the Scottish Oil Companies and the Anglo-Persian Oil Co. Ltd.—The Anglo-Persian Oil Co. Ltd. has made proposals to the Scottish oil companies offering to purchase the whole of their issued ordinary shares, and to form a new company, to be called "The Scottish Oil Company Ltd.," with a capital of £4,000,000, of which £3,000,000 would be in 7 per cent. £1 non-cumulative participating preference shares and £1,000,000 in ordinary £1 shares. The preference shares to be issued in payment of the shares in the existing Scottish oil companies and the ordinary shares to be subscribed for in cash by the Anglo-Persian Co. On the formation of the new company, the Anglo-Persian Co. would agree to supply to it, as from January 1, 1923, such quantities of crude oil as may, with the supplies of crude oil from shale, be necessary to keep the present refineries running at full capacity, and at a price sufficient to enable the new company to pay the dividend on the new preference and ordinary shares and to leave a surplus for division between both classes.

PERSONALIA.

Sir A. D. Steel Maitland has resigned his post of head of the Department of Overseas Trade at the Board of Trade.

The death is announced from Berlin of Prof. Emil Fischer at the age of 67.

Dr. Paul Haas has been appointed lecturer in plant chemistry and Dr. F. W. Goodbody lecturer in medical chemistry, at University College, London.

The post of Professor of Mines at the Royal School of Mines, vacant by the resignation of Prof. W. Frecheville, has been filled by the appointment of Mr. S. J. Truscott, who has been assistant professor for the last seven years.

Mr. T. Crook, an assistant superintendent of the Scientific and Technical Research Department and Technical Information Bureau at the Imperial Institute, has been appointed head of the Intelligence and Publications Section of the Imperial Mineral Resources Bureau.

Dr. A. J. Clark has been appointed to the University chair of pharmacology at University College, London, in succession to Prof. A. R. Cushny. He previously held the chair of pharmacology in the University of Cape Town.

Prof. A. Findlay, professor of chemistry at the University College of Wales, Aberystwyth, has been appointed to succeed Prof. F. Soddy as professor of chemistry at the University of Aberdeen.

Mr. E. Grant Hooper, Deputy Chief of the Government Laboratory, retired at the beginning of this month, under the age regulations, after more than forty years' service. He had held the above post since 1912, prior to which he was in charge of the Crown Contracts branch of the Government Laboratory. Mr. Grant Hooper's successor as Deputy Chief Chemist is Mr. J. Connah, who has hitherto been in charge of the branch laboratory at the Custom House.

At Manchester University, Mr. D. H. Bangham has been appointed lecturer in chemistry, and Dr. J. K. Wood, of Dundee, lecturer in physical chemistry in the faculty of technology.

It is announced that Prof. W. M. Gardner, Principal of the Bradford Technical College since 1906, and head of the Chemistry and Dyeing Department since 1895, is retiring on account of ill-health.

Prof. T. Brailsford Robertson has been appointed to succeed the late Sir E. C. Stirling as professor of physiology in the University of Adelaide. Prof. Robertson was formerly professor of biochemistry at Toronto University.

Sir J. J. Thomson has been elected to a newly-established chair of experimental physics at Cambridge University, which will terminate when he resigns office unless the University determines otherwise. Other appointments at Cambridge University include:—Mr. F. W. Dootson to a lectureship in chemistry, and Mr. W. H. Miller to a lectureship in organic chemistry.

OBITUARY.

SIR JOHN BRUNNER, BART.

John Tomlinson Brunner, one of the founders of the firm of Brunner, Mond and Co., was born at Everton, near Liverpool, in 1842, where his father, the Rev. John Brunner, of Zürich, kept a school. He was educated at this school until the age of 15, when he entered upon a commercial career with a Liverpool firm, subsequently obtaining an appointment at the chemical works of Messrs. J. Hutchinson and Co., alkali manufacturers, of Widnes, where he remained eleven years. It was there that he first met the late Dr. Ludwig Mond who had come to the same works to elaborate a process for the recovery of sulphur from alkali waste. The friendship which grew up between the two men ripened ultimately into a business partnership which was destined to play a very important part in the development of the heavy chemical industry of Great Britain. This partnership of commerce and science was formed to work and develop the Solvay ammonia-soda process in this country. The difficulties encountered in the early days of the firm were many—in fact, as Sir J. Brunner was wont to relate, nearly everything exploded or broke, except the firm's credit. Starting with a small capital, a single factory with 40 workers and a yearly output of 800 tons of soda, the business steadily progressed until to-day it has a nominal capital of £15,000,000, numerous works, many thousands of employees and a normal annual output approaching 1,000,000 tons. Combined with those indispensable attributes of a successful business man, foresight and initiative, Sir John Brunner possessed that humanising touch which kept him on the best of terms with his employees and enabled his firm to secure the pick of the local labour market. He introduced profit-sharing in 1907, a sick-benefit scheme, at the cost of the company, developed first-aid and ambulance work, and originated the system of granting an annual holiday of one week with two weeks' pay to every worker who had not absented himself without permission for more than two days in the previous year. His generosity and welfare work were not confined to his own business; he took an active interest in and promoted many local movements, erected and assisted schools and public libraries, and founded a chair of Economics (by a gift of £10,000) and a chair of Egyptology at Liverpool University. He also gave £5000 for the National Physical Laboratory and a like sum to a hospital in Bulach,

Switzerland, of which town his ancestors had been burgesses since the 14th century.

The deceased baronet had a long and useful career as a member of Parliament, where he worked as an advanced Liberal with a tendency towards independence. He was a pronounced democrat, a free-trader and a Home-Ruler. Among the Royal Commissions he served upon was that on Canals and Waterways in 1906, where he was able to give point to the agitation he had started 21 years previously in favour of Government control to secure the development of this neglected means of transport.

He was created a baronet in 1895 and appointed a Privy Councillor in 1906. His death on July 2, after a brief illness, removes yet another original member of this Society and a figure everywhere known and respected in the world of chemical industry. He leaves two sons and three daughters; the eldest son, Mr. J. F. L. Brunner, succeeds to the title, and the second, Mr. Roscoe Brunner, is chairman of Messrs. Brunner, Mond and Co., a position held by his father for over 40 years.

PROF. ADRIAN J. BROWN.

By the passing away of Adrian J. Brown, F.R.S., M.Sc. (Birmingham), Director of the British School of Malting and Brewing, and Professor of the Chemistry and Biology of Fermentation at Birmingham University, on July 2, three days after the death of his wife, the world loses one of its foremost scientific workers in the domain of fermentation, and a man held in esteem and affection by all privileged to know him.

Born in 1852 at Burton-on-Trent, and educated first at the Grammar School of his native town and later at the Royal School of Mines, Adrian Brown acted for some time as assistant to the late Dr. Russell at St. Bartholomew's Hospital, and afterwards accepted the position of chemist at the brewery of Messrs. Salt and Co., of Burton-on-Trent. His duties in the brewery did not prevent him from investigating problems more purely scientific in character, and to this period belong some of his more important investigations on yeast growth, the mechanism of enzyme action, the heat of fermentation, etc., now ranking as classics, as well as the discovery and study of *Bacterium xylinum*. His work on semi-permeable membranes, in particular of the barley-corn, and that on the organism known as *Bacterium X*, were carried out during his occupancy of the Birmingham chair, which he filled with conspicuous success from the inauguration of the School of Malting and Brewing in 1899 to the day of his death.

Essentially fair-minded, a sportsman in the best sense of the term, and possessed of an intimate first-hand knowledge of natural history in all its branches, he was as far removed from the dry pedant as day from night, and no student who came under his influence could fail to derive profit therefrom.

His published work bears the stamp of the man and, what is indeed rare nowadays, when speech and action so often precede the taking of thought, none of it has ever required subsequent defence or modification.

Professor Brown served for some years as Examiner in Biological Chemistry to the Institute of Chemistry, as President of the Institute of Brewing, and as a member of the Council of the Chemical Society. He was elected a Fellow of the Royal Society in 1911.

He is survived by two sons and two daughters.

THOMAS H. POPE.

REVIEW.

BIOCHEMICAL CATALYSTS IN LIFE AND INDUSTRY. PROTEOLYTIC ENZYMES. *By* JEAN EFFRONT. *Translated by* S. C. PRESCOTT. *Pp. xi* + 752. *(New York: J. Wiley and Sons, Inc. London: Chapman and Hall, Ltd.* 1917.) *Price* 23*s. net.*

Effront's earlier work on "Enzymes and their Applications" was a classic in its day and by far the most readable book on the subject for the general student. The present volume hardly maintains this standard, though it must be admitted that the author has set himself a task of the highest magnitude. The treatment is unequal and much work of fundamental importance, particularly that published in English journals, is ignored or only very scantily quoted, thereby detracting greatly, if not entirely, from any claim of the work to be authoritative. The work of Emil Fischer, of Abderhalden and of Van Slyke in their respective fields, to mention three names only, has carried the knowledge of the protein molecule far beyond the days of Schützenberger.

After a preliminary section, Part I deals with the coagulating catalysts—thrombin, myrosinase and rennet. Successive parts are devoted to pepsin, trypsin, erepsin, and amidases and a final section deals with the applications of the enzymes in industry. The nomenclature is hardly all that can be desired, probably because the French have not yet followed international custom in this respect and the translator has been content to paraphrase the French names: galactase, for example, should be an enzyme splitting galactosides and not a trypsin.

From the point of view of our readers the most important section is that devoted to the application of the enzymes, which occupies a quarter of the book. Official pepsin is carefully described with special reference to the exacting requirements of the French codex. A section on the chemical and enzymic exploration of the stomach is very complete and suggestive. The *rôle* of proteolytic enzymes in breadmaking is discussed, but the references are very incomplete and the statements made, as well as the theory based on them, are of doubtful accuracy. The part played by proteolytic enzymes in brewing has been the subject of many British researches culminating in those of Horace Brown: as this work receives anything but adequate treatment the section must be regarded as unsatisfactory. Similar sections are devoted to the activity of proteolytic enzymes in yeast manufacture, cheese making and tanning.

The catalysts of the soil are somewhat fully dealt with, the author throughout writing of bacteria as if they were catalysts: this seems a bold extension of the accepted definition of an enzyme.

Some useful notes on the recovery of nitrogenous wastes contain the practical experience of the author. A final section deals with the work of Pechère in Belgium, subsequently taken up by Abderhalden, on the nutritive value of products of advanced hydrolysis of protein substances.

As already stated the book is unequal in treatment and must be read very critically by those using it. None the less it is written with much grace and charm, and the perusal of its pages cannot fail to be of value to all workers in this difficult subject.

E. F. ARMSTRONG.

PUBLICATION RECEIVED.

EXPLOSIVES. *By* E. DE BARRY BARNETT. *Industrial Chemistry, edited by* S. RIDEAL. *Pp.* 241. *(London: Baillière, Tindall and Cox.* 1919.) *Price* 12*s.* 6*d.*

EMPIRE SUGAR.

No feature of the recent annual meeting of the Society attracted more general interest than the Preliminary Report of the Empire Sugar Supply (Technical) Committee, which was presented at Clothworkers' Hall, Mincing Lane, E.C., where a conference on the subject was held on July 16, the Earl of Denbigh presiding. Nor is the interest evinced in the Committee's work at all surprising, when we bear in mind the important place sugar now holds in our daily life. As the report (*v* p. 287 T) points out, sugar in days of yore was consumed as a condiment or even as a medicine, but it has become during the last few centuries one of the most important articles of dietary among civilised nations. As regards our own country, let it be remembered that the United Kingdom consumes sugar in different forms at the rate of more than 90 lb. *per capita* per annum.

There are many interesting facts connected with the production and consumption of sugar within the Empire. First and foremost it may be pointed out that we produce more sugar than any other State in the world, which, however, is by no means consistent with another fact—*viz.* that, prior to the war, more than 96 per cent. of the sugar imported into the United Kingdom came from foreign countries, the greater part—80 per cent. of the total—being European beet sugar.

The sugar produced within the British Empire is principally derived from sugar cane, and the problem which the Committee set itself to solve was whether the Empire can be rendered self-supporting as regards its sugar supply. The first question is: How do we stand at the present time? In this connexion we cannot do better than refer to the report, and more especially to the explanation given by Mr. J. W. Macdonald of the statistical tables compiled by the Committee from the data they have collected. From these it appears that the Empire is consuming about 6,250,000 tons of sugar annually, whilst it produces normally about 3,350,000 tons per annum, so that there is a shortage of more than 2,500,000 tons in the annual production of sugar if the Empire is to become self-supporting. The question is: Can we make up this deficiency; and, if so, how can it be done?

The report deals at some length with the question of the establishment of a beet sugar industry in the United Kingdom, a project with which it will be remembered Lord Denbigh has been associated for some years. That we can grow beets of sugar content and purity equal to those produced on the continent of Europe has been abundantly proved. On the other hand our farmers have much to learn as regards the cultivation of this particular crop, and until the enterprise is placed on co-operative lines, the farmer getting an interest in the factory and the sugar maker in the farm, no regular supply of roots—a factor essential to success—can be assured. Doubt has often been expressed as to whether we have sufficient land in this country to warrant the establishment of a new agricultural industry; but here it may be pointed out that there are thousands of acres available, and there need be no fear that the land put under beet would reduce the acreage now under wheat and other cereals. Far from it, with the establishment of a sugar industry much land now practically lying idle could be utilised for the purpose, and since beet is such an excellent rotation crop, opening up the soil better than any other, this land would also be available in some years for cereals. It has been stated that the present high efficiency of agriculture in Germany would not have been attained without the beet industry.

As an imperial question, however, the problem of increasing the production of sugar in our Empire beyond the seas is the most weighty. Many of the speakers at the conference pointed to India, with which country the report deals at length, as the portion of the Empire in which the sugar shortage could be made up. India until recently produced more sugar than any country in the world. The latest returns show that Cuba now holds the premier position. But practically the whole of the Indian sugar is that known as gur, a soft variety produced by the natives for their own consumption by primitive methods, involving much waste. This gur is unfit for refining, and over and above the 2,500,000 tons normally produced of it per annum, some 800,000 tons of ordinary raw and refined sugar are imported annually. Prior to the war some of this was German and Austrian beet sugar. It is understood that a Commission is about to be appointed to investigate the sugar problem in India. Many reforms will be required. The present small holdings must be converted into estates to supply central factories with cane, and sugar must be produced by modern methods. There is one respect in which India occupies a unique position in comparison with the rest of the Empire. There is an abundance of labour. Most valuable work is now being carried out in the selection of seedling canes by cross fertilisation, and for much of this we are indebted to Dr. C. A. Barber.

Sir Alfred Chatterton said that the exportation of sugar from India to this country had fallen off about sixty years ago, and the demand in India for sugar was likely to continue to increase, so that no surplus of sugar could be expected for many years. Any increase in sugar production must be accompanied by the introduction of modern machinery and methods. The replacement of sugar by other crops had also to be borne in mind. One great aim would be to produce a sugar which would keep for a longer period than the native gur. Small power-driven mills worked with oil engines and suction gas had been installed by the Government, and these extracted 25 per cent. more juice than the country mills.

Sir Francis Watts, the Imperial Commissioner of Agriculture for the West Indies, made a most illuminating speech at the meeting. He expressed the opinion that there remained but few British tropical colonies in which the condition of the sugar industry was such as to encourage capitalists to come forward to its extension. As regarded the West Indies, Sir Francis thought that much could be done, and Jamaica with an effort could raise its sugar production to 200,000 tons per annum. He was of opinion, however, that unless some measure of assurance were given to those who desired to produce British sugar, they would be ousted by foreign producers who were already equipped for the purpose.

Taking a broad view of the possible outcome of this important work, it must not be thought that the Committee's objects will be consummated all at once. There are parts of the Empire besides those mentioned which could be put under cane cultivation; to cite one, there is the West Coast of Africa. As a matter of fact the work can only bear fruit after a number of years, and then not unless it receives encouragement from the Imperial Government. In the meantime, Mr. Arthur R. Ling and his Committee are undoubtedly to be complimented upon the valuable and arduous work which they have accomplished, work which not only adds testimony to the public utility of the Society of Chemical Industry, but which also marks a step forward towards the attainment of economic independence within the Empire.

REPORT OF THE COMMITTEE ON THE STANDARDISATION OF LABORATORY GLASSWARE.

The suggestion that the Society of Chemical Industry should take up the question of the standardisation of laboratory glassware was made on the occasion of the reading of a paper on "Scientific Glassware" by Dr. Morris Travers at the Annual General Meeting of the Society at Bristol in July 1918 (see Journal of the Society of Chemical Industry, vol. 37, p. 235 T). Dr. Travers subsequently brought the matter before the British Chemical Ware Manufacturers' Association, which approved of the suggestion that the Society should take the initiative in the matter and assured Dr. Travers of its heartiest co-operation. A letter was received later from the Controller of Optical Munitions and Glassware Supply of the Ministry of Munitions, supporting the suggestion that standardisation should be effected as early as possible, and offering the services of a member of his technical staff to discuss the best methods of procedure to be adopted. On October 21, 1918, Mr. F. W. Branson, of Messrs. Reynolds & Branson, Ltd., of Leeds, read a paper on "Some Aspects of the Chemical Glassware Industry" (including Standardisation), before the Yorkshire Section of the Society. (See J.S.C.I., vol. 37, p. 337 T.)

At the meeting of Council of the Society held on October 24, the President proposed that a committee should be appointed to confer with other interested bodies on the subject, with a view to cutting down the supply of various classes of apparatus to a certain number of standard sizes, and he intimated that the Société de Chimie Industrielle was prepared to co-operate in the matter. This proposal was agreed to, and the following were appointed to serve on the Committee:—Sir Robert Hadfield, Mr. K. Chance, Sir Herbert Jackson, Dr. C. Carpenter, Mr. W. F. Reid, Dr. Travers (Convener), with the President (Prof. Louis) and the Hon. Treasurer (Mr. D. Lloyd Howard) *ex officio*.

At the first meeting of the Committee, held on November 20, the subject was discussed in a preliminary manner, and it was strongly felt by the members present that it was necessary in the first instance to obtain the views of manufacturers, users, and the retail trade. The Committee therefore asked the Council to authorise it to obtain the co-operation of representatives of these bodies, and the Council at its meeting in November authorised the Committee to co-opt other members and to call in the assistance of associations or individuals at its discretion. The Committee acting on this authority has since co-opted the following members:—Mr. Arnold Stevenson (Glassware Supply, Ministry of Munitions), Mr. V. Stott (National Physical Laboratory), Dr. J. J. Fox (Government Laboratory), Mr. J. R. Griffin (British Laboratory Ware Association), Mr. F. W. Branson of Leeds, Mr. D. P. Berridge and Mr. F. A. Beesley (Science Masters' Association), Mr. G. F. Baker (British Lamp-blown Scientific Glassware Manufacturers' Association), Dr. S. Rideal (Society of Public Analysts), Mr. T. A. Moore (India Office), Mr. G. A. Mallinson, interim (Pharmaceutical Society), Dr. W. E. S. Turner (Society of Glass Technology), Lt.-Col. D. Harvey (War Office). Mr. Kenneth M. Chance, owing to business engagements, has had to resign his membership of the Committee.

In dealing with each class of apparatus the Committee in the first instance set to work to collect information as to the varieties and sizes manufactured before and during the war, and statistics of sales by the distributing firms, which gave the only definite indication of the relative demand for different articles. In the case of beakers the Committee also endeavoured to obtain the views of users as to the forms and sizes which should be manufactured, by addressing an inquiry to certain of the more important professional bodies, but the answers which they received were so indefinite that the method was not followed up. As it frequently happened that important information with regard to a particular kind of glassware was received when the inquiry relating to it appeared to have almost reached a conclusion, the work of the Committee has been somewhat prolonged.

In making its recommendations the Committee has had due regard for the fact that much money had already been spent on moulds, and that it would be quite useless to advise the manufacturers to replace existing moulds by new ones, without very strong reasons for doing so.

All dimensions and capacities are given in metric measure, which the Committee considers should be more uniformly adopted. This point is important, if an export trade in scientific glassware is to develop in connexion with such countries as South America.

CYLINDRICAL BEAKERS.

The study of the problems connected with this section of the subject occupied a considerable amount of time. Detailed information as to the sizes manufactured by British, German and Austrian houses was laid before the Committee, and also statistics as to the relative numbers of the various sizes of beakers sold by the principal dealers in this country. Every endeavour was made to ascertain the views of users as to the forms and sizes of beakers most commonly employed in scientific and analytical laboratories. Suggestions made by both manufacturers and dealers with a view to cheapening production and distribution had also to be considered.

So extensive was the information which was ultimately collected, that it was necessary to appoint a Sub-Committee to deal with it. On the report of the Sub-Committee the Committee decided to make certain definite recommendations which are detailed below:—

It appeared that three kinds of beakers were on the market:—(*a*) A squat form with or without spout, (*b*) a medium form, (*c*) a tall form. It was generally agreed that two forms would meet all requirements.

The thicknesses of the walls of beakers should approximate to those set down in the table. It was decided that no advantage is to be gained by specifying as the nominal capacity of a beaker the approximate content when filled to a definite distance from the top, because in analytical practice a beaker is usually half filled with liquid, but that the capacity of a beaker should be specified as the approximate content when filled to the brim with liquid. The total height, and the external diameter immediately above the curve at the base should also be catalogued. From the point of view of the user the taper in beakers should be slight, otherwise precipitates tend to settle on the walls; a slight taper is also desirable from the manufacturing point of view, so that the article when blown may be easily freed from the mould. For storage purposes the tapering of beakers is an advantage, for the greater the taper, the greater is the number of beakers of a single size which can be stored in a bin. It was decided that a taper of 1 in 20 on the diameter should be adopted.

From the manufacturing point of view it is important that the series of beakers should be so designed that corresponding numbers of the squat and tall beaker series should have identical diameters at the base, so that a tall beaker spoiled in the process of manufacture could be cut down to

the height of the squat beaker. This principle, which had been employed by Bohemian manufacturers and by one English firm, was adopted by the Committee.

While it was of equal advantage to manufacturers, dealers, and users, to reduce the number of beakers in the series, in arriving at a decision as to the series which should be adopted, close attention had to be paid to the following points :—

(*a*) The series must contain those sizes which are in most common use. (*b*) The space between the beakers must be such as to allow of packing material being placed between adjacent members when the beakers are nested. The space between the beakers must increase with increase in diameters of the beakers. (*c*) When the beakers are nested the rim of each beaker must rest on the rim of the next in series. (*d*) The general appearance of the beakers when nested in series must not be left out of account.

It was finally decided to adopt the following series of diameters :—26, 30, 35, 41, 48, 56, 65, 75, 86, 98, 111, 125, 140, 156, 173 mm.

Finally, the ratio of the height to the diameter of the beakers in the two series was considered, and after reviewing the information which had been collected with regard to existing series, it was decided to adopt the values 1·37 and 2·0 as the values of the ratio, overall height to diameter near base, for squat and tall series respectively.

TALL SERIES.

Ratio $\frac{\text{Height}}{\text{Diam.}} = \frac{2}{1}$ Taper = 1 in 20.

A No.	B External diam. near base	C Thickness of walls	D Overall height	E Approximate capacity to level of brim	No.
	mm.	mm.	mm.	c.c.	
0	26	0·5	52	25	0
1	30	0·5	60	40	1
2	35	0·5	70	60	2
3	41	0·5	82	100	3
4	48	0·75	96	160	4
5	56	0·75	112	250	5
6	65	0·75	130	400	6
7	75	0·75	150	600	7
8	86	1·00	172	1000	8
9	98	1·00	196	1500	9
10	111	1·00	222	2000	10
11	125	1·00	250	3000	11
12	140	1·25	280	4000	12
13	156	1·25	312	6000	13

SQUAT SERIES.

Ratio $\frac{\text{Height}}{\text{Diam.}}$ = 1.37 to 1. Taper = 1 in 20.

A No.	B External diam. near base	C Thickness of walls	D Overall height	E Approximate capacity to level of spout	No.
	mm.	mm.	mm.	c.c.	
1	30	0·5	41	25	1
2	35	0·5	48	40	2
3	41	0·5	56	60	3
4	48	0·75	66	100	4
5	56	0·75	77	160	5
6	65	0·75	89	250	6
7	75	0·75	103	400	7
8	86	1·0	118	600	8
9	98	1·0	134	900	9
10	111	1·0	152	1300	10
11	125	1·0	171	2000	11
12	140	1·25	192	2750	12
13	156	1·25	214	4000	13
14	173	1·25	237	5000	14

The preceding tables give the dimensions of two series of beakers recommended for adoption by the Committee. It is also recommended that the data set down in columns A. B. D. and E, be given in price lists and catalogues.

Beaker Flasks and Conical Beakers.

It appeared to the Committee that no advantage would be gained by suggesting that manufacturers should make new moulds for beaker flasks and conical beakers. It recommends, however, that the greatest diameters, the heights, and the total capacities of these articles should be catalogued.

FLASKS.

The Committee considers that a flask should hold at least the nominal capacity when filled with liquid to the level of the base of the neck. The nominal capacity and the external diameter of the neck should be catalogued.

The flange of a flask should be turned over sharply, the mouth should not be belled.

It did not appear to the Committee that any material advantage was to be gained by reducing the number of round and flat-bottomed flasks manufactured, except in so far as it might be possible to eliminate one or the other of almost identical sizes such as those corresponding to 100 and 125 c.c., 350 and 400 c.c., 700 and 750 c.c., 1250 and 1300 c.c. The sizes of flasks between 50 and 10,000 c.c., which it considers to be sufficient to meet all requirements, are set down in the following table. Of these flasks, those corresponding to 600, 1250, and 2500 c.c. are retained, as they correspond to the pint, quart, and the 2 quart sizes, and are therefore in demand for certain purposes.

It was suggested to the Committee that if flasks, over a considerable range, had necks of the same diameter, the number of sizes of rubber stoppers which it would be necessary to stock in the laboratory, might be considerably reduced. The Committee decided not to adopt the suggestion.

The Committee recommends that as new moulds come to be made, the necks should conform to the following dimensions :—

(*a*) FLAT, ROUND-BOTTOMED AND CONICAL FLASKS.

Capacity of flask cc.	External diameter of neck mm.	Capacity of flask cc.	External diameter of neck mm.
50	17	(1250)*	33
100	18	1500	35
150	18	2000	40
200	21	(2500)*	40
250	25	3000	45
350	25	4000*	45
500	27	5000	55
(600)*	27	7500	60
750	29	10,000	65
1000	33		

* Flat and round-bottomed only.

It appears that there is still a demand for the pear-shaped as well as the globular form of flask.

(*b*) WIDE-MOUTHED FLASKS WITH SHORT NECKS.

i. Flat-bottomed flasks, known as CO_2 flasks or extraction flasks.

ii. Round-bottomed flasks, known as bolt heads.

Capacity cc.	Diameter of neck mm.	Capacity cc.	Diameter of neck mm.
50	30	750	50
100	35	1000	55
150	35	1500	55
250	40	2000	60
350	40	3000	60
500	45	5000	65

Flat-bottomed flasks to 500 cc. capacity only.

In view of the fact that a very considerable number of moulds for the short, wide-mouthed flasks, with flat and round bottoms (known as extraction or CO_2-flasks, and bolt-head flasks respectively), are already in the hands of various manufacturers, the Committee suggests that the manufacturers should confer amongst themselves with a view to eliminating unnecessary sizes at once.

(c) Distillation flasks.

Capacity cc.	Diameter of neck mm.	Length of neck mm.
50	12	135
100	15	145
150	17	155
250	20	170
350	20	185
500	23	200

Larger sizes as round-bottomed flasks.

(d) Kjeldahl flasks.

Capacity c.c.	Diameter of neck mm.	Capacity c.c.	Diameter of neck mm.
100	22	300	28
200	25	500	30

(e) Conical filtering flasks.

The flasks must be well annealed, evenly blown, and thick in the walls, so as to be able to stand exhaustion, and filling with boiling liquid without cracking. The neck of filtering flasks to take rubber stoppers should be turned out sharply and not belled. The tubulure should be so drawn out as to take thick walled rubber tube 3/16 in. internal diameter. The internal diameter of the neck should be at least :—

Capacity c.c.	Diameter mm.	Capacity cc.	Diameter mm.
100	25	1500	40
250 or 300	33	2000	45
500	35	3000	45
750	40	5000	50
1000	40		

Kipp's Apparatus.

The overall height and the diameter of the middle bulb should be listed.

The Committee considers that four sizes corresponding to 85 mm., 105 mm., 125 mm., and 180 mm.; or 250, 500, 1000, and 2000 c.c. should meet all requirements.

FUNNELS.

(a) Plain or fluted funnels of thin glass.

It is of very great importance that funnels should be made so that, in the case of plain funnels, a hardwood cone accurately turned to an angle of 60° will fit into the inside without side play. In the case of ribbed funnels the ribs should be pronounced on the inside.

Funnels should be ground flat on the top.

The stems should either be of parallel bore, or should taper slightly to the point; taper in the reverse direction is objectionable. The point should be ground off at an angle of about 30°.

Though the sizes of funnels are generally catalogued in inches, the Committee suggests that the dimensions should in future be given in millimetres. The series 1, 1½, 2, 2½, 3, 3½, 4, 4½, 5, 6, 8, 10, 12 inches, should be replaced by the series 30, 45, 60, 75, 90, 105, 125, 150, 200, 250, and 300 mm., the number in the series being reduced from 13 to 11, the sizes 3, 3½ and 4 in., which are important, corresponding almost exactly with the sizes 75, 90, and 105 mm.

The following is a summary of the suggested dimensions of funnels :—

Outside diameter across top mm.	Approximate length of stem mm.	Approximate external diameter of stem mm.
30	45	5
45	60	5 to 6
60	75	6 to 8
75	90	8 to 10
90	105	8 to 10
105	120	10 to 12
125	130	10 to 12
150	150	12 to 15
200	165	15 to 20
250	180	20 to 23
300	200	22 to 25

(b) Deeply ribbed funnels, pressed.

The following sizes, for which press moulds already exist, were adopted by the Committee :—

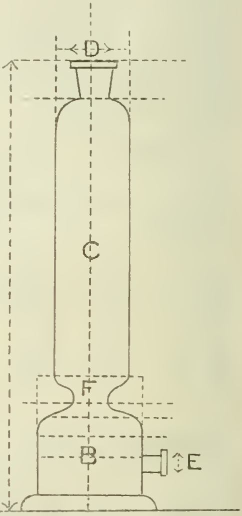
7, 9, 11, and 16 cm.

DRYING TOWERS.

The total height and the diameter of the cylindrical portion should be catalogued. The tubulure at the base should not be less than 15 mm. in diameter at the outer end. The following dimensions of drying towers—from moulds which already exist—are recommended for adoption :—

No.	A	B	C	D	E	F
1	200	45	40	25	15	15
2	250	55	45	30	15	18
3	300	65	50	30	15	18
4	400	90	65	30	15	22

It is important that the internal diameter of the constriction should be less than the minimum internal diameter of the neck.



DESICCATORS.

The catalogued dimension of a desiccator should be the internal diameter of the opening of the container portion of the apparatus.

The dimensions of a desiccator should be such that the depth of the part of the apparatus in which the article or material to be dried is placed should be at least two-thirds of the diameter of the opening

The ground contact surface between the body of the apparatus and the lid or cover should be at least 15 mm. for 100, 125, and 150 mm. sizes, and 20 mm. for 200 and 250 mm. sizes. In the case of vacuum desiccators, the ground contact surface should not be less than 20 mm. in any case.

The Committee considers that the following

variety and sizes of desiccators will meet all requirements:—

Scheibler form (plain, with tubulure in lid, and with tubulure in side), 100, 125, 150, 200, and 250 mm.; Fresenius form, 125 mm.; Hempel form, 150 mm.

ASPIRATORS AND WOULFF'S BOTTLES.

The Committee recommends that the diameter and height overall be listed. The vessel should contain at least its nominal volume when filled with liquid to the base of the neck.

The ratio of the diameter to the height to the base of the neck should not be less than 3 to 5.

The taper of the necks and tubulures should be such as to correspond to change in diameter at a rate corresponding to about 1 in 7, so as to allow of stoppering, and to fit corks and rubber stoppers.

In the case of Woulff's bottles, it is important that the side necks be so placed that a glass tube can pass through the centre of a cork in the neck vertically to the bottom of the bottle.

It is considered that the following sizes will meet all requirements:—

Nominal capacity cc.	Minimum internal diameter of necks mm.	Minimum internal diameter of tubulures mm.
125*	15	15
250	15	15
500	20	15
1000	25	20
2500	32	20
5000	40	25
7500	40	25
10,000	40	25
15,000	45	25

* Woulff's bottle only.

GRADUATED APPARATUS.

The Committee desires to call attention to the facilities offered by the National Physical Laboratory for the testing of graduated glassware. The Committee has had before it copies of a pamphlet dealing with "Volumetric Tests on Scientific Glassware" issued by the National Physical Laboratory in July, 1918, in which full information relating to the details of these tests is given. Copies of this publication may be obtained free of charge on application to The Director, The National Physical Laboratory, Teddington, Middlesex. The pamphlet deals with Class A Tests, that is, the examination of apparatus in which the highest degree of accuracy is required, and vessels which pass the tests have the Laboratory mark, which is a combination of the Laboratory monogram and the date of test, etched on them. Apparatus submitted for Class A Tests and found to be outside the limits of acceptance for standard apparatus is, if considered of reasonable accuracy for commercial purposes, given the Class B mark. In addition to the Class A tests the Laboratory has now under consideration Class B tests, that is, the examination of apparatus primarily intended to possess only commercial accuracy. It is hoped that it may be possible to complete the final arrangement for these tests in the near future.

(a) Pipettes.

The dimensions recommended for single-mark bulb pipettes are given at bottom of page.

In view of the great divergence in opinion and practice amongst chemists in their methods of using pipettes and burettes it was thought desirable to include in this report brief notes on this subject.

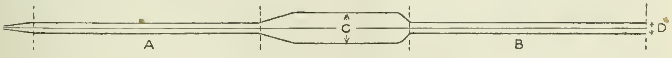
With regard to pipettes, numerous methods of using one mark delivery pipettes have been proposed from time to time; but all may be included in one or other of the two following classes:—

(a) Those in which the small quantity of liquid which remains in the jet is allowed to stay there, and

(b) Those in which this liquid is ejected, *e.g.*, by blowing down the pipette, or by closing the top of the pipette with one finger and warming the bulb by clasping it with the other hand.

Methods in which the small quantity of liquid which collects in the jet of a pipette when outflow has ceased is allowed to remain there are more reliable than those involving the ejection of this liquid. The latter methods are, therefore, not to be recommended. With regard to the former methods it is essential in order to obtain the best results to have a perfectly definite order of procedure. Recommendations as to the procedure to be followed are given below. In order to obtain results with pipettes tested at the National Physical Laboratory which shall be in agreement with the values certified, the pipette should be used in accordance with the conditions of test printed on the certificate of corrections. In cases, however, where one is prepared to accept the nominal value of a pipette provided that it is correct within reasonable limits the following method may be used, with pipettes calibrated in accordance with the National Physical Laboratory methods of test, without introducing appreciable errors.

The pipette is filled with liquid to a short distance above the mark. Liquid is then run out until the meniscus is on the mark and the outflow is then stopped. The drop adhering to the tip is removed by bringing the tip of the pipette into contact with the surface of the liquid from which it has been filled and then removing it without jerking. The pipette is then held vertically and allowed to deliver with the jet touching the side of the receiving vessel, the vessel being slightly inclined. The pipette is allowed to drain for 15 seconds after outflow has ceased, with the tip still in contact with the side of the vessel, and the pipette itself vertical. On completion of the draining time the vessel is removed from contact with the tip of the pipette, thus removing any drop adhering to the outside



Capacity .. c.c.	1	2	4	5	10	25	50	75	100
A .. .. mm.	95	100	120	120	190	200	200	200	165
B .. .. mm.	110	115	120	120	160	200	200	200	200
C (int.) .. mm.	5·5 to 6·5	7 to 7·5	10 to 10·5	11·5 to 12	13·5 to 14	17 to 18	27 to 28	30 to 31	35 to 36
D (int.) .. mm.	2	2	3	3	4	5	5	5	7
Distance of mark above bulb, about .. mm.	25	35	35	35	40	50	50	50	50

of the pipette. To determine the instant at which outflow ceases, the motion of the liquid surface down the delivery tube of the pipette is observed, and the delivery time is considered to be complete when the meniscus comes to rest slightly above the end of the delivery tube. The one-fourth minute draining time is counted from this moment.

The method just described in detail differs from the method of test at present employed at the National Physical Laboratory only in the following particulars:—

(*a*) The pipette is allowed to deliver with the jet continuously in contact with the walls of the receiving vessel instead of using free delivery.

(*b*) At the end of the one-fourth minute drainage time the drop adhering to the pipette is detached against the side of the receiving vessel instead of on the surface of the liquid already delivered.

As stated previously, when a pipette is being used for work in which, if the pipette is accurate within reasonable limits, it is sufficient to accept its nominal volume for delivery as the correct volume delivered, then it is immaterial whether the National Physical Laboratory method is adhered to strictly or the alternative method given above be used. The difference between the results obtained by the two methods is appreciably less than other possible incidental errors. This is assuming of course that the pipette was initially calibrated for the above methods of use. If, however, such a pipette is used by methods involving the ejection of the drop of liquid, which in the above methods is allowed to remain in the pipette, the results obtained may differ very appreciably from the volume delivered by the method for which it was calibrated. In view of the fact that more reliable results are obtainable by the methods of using pipettes described above than by injection methods, it is recommended that manufacturers should continue to calibrate pipettes in accordance with the conditions of test specified in the National Physical Laboratory test pamphlet previously referred to. Further, in order to secure uniformity of results it is desirable that users of pipettes should follow the above recommendations as to method of use. In arriving at the conclusions set out above the results of a recent investigation on different methods of using pipettes carried out at the National Physical Laboratory were available to the Committee, and will be published in the Society's Journal in the near future.

Burettes.

Two of the main sources of error in the use of burettes are:—

(*a*) Change in rate of delivery arising from different manipulation of the tap on different occasions. This causes a variation in the volume of liquid delivered corresponding to a given interval on the burette. (*b*) Change in reading due to drainage of liquid down the walls of the burette.

Quite large errors may arise from these causes and often escape detection in ordinary analytical work, particularly if burettes with quick delivery times are used. By delivery time is meant the time occupied by the outflow of water from the zero graduation mark to the lowest graduation mark when the tap is fully open. The possibility of errors arising from the above causes is reduced to a very considerable extent by using burettes with comparatively long delivery times.

The times of delivery specified by the National Physical Laboratory for burettes submitted for Class A tests are given in Table A.

The minimum times of delivery have been so chosen that for tubes of the diameters ordinarily employed for burettes, the rise in the meniscus due to drainage shall not exceed approximately 0·05 mm. in the first two minutes after closing the tap. The maximum times have no physical significance but merely fix an upper limit in order to avoid the rate of delivery being made intolerably slow.

Table A.

Length graduated, cm.	Minimum time of outflow, sec.	Maximum time of outflow, sec.
15	30	60
20	40	80
25	50	100
30	60	120
35	70	140
40	80	160
45	90	180
50	100	200
55	110	220
60	120	240
65	130	260
70	140	280
75	150	300

With burettes conforming with the above limits as to delivery time, the second cause of error mentioned at the outset, *viz.*, change in reading due to drainage, is practically eliminated. The errors introduced by increasing the time of delivery above the natural time of delivery of the burette are also very much smaller than would be the case with burettes calibrated for a quick delivery.

With burettes calibrated for the above delivery times the only demands made upon the user in order to obtain results in agreement with those obtained in testing the burette are:—

(1) The burette should be allowed to deliver with the tap fully open. (2) The reading should be taken immediately after the required amount of liquid has been run from the burette. (3) The 0 c.c. mark of the burette should be taken as the starting point.

The mode of manipulation is thus extremely simple and makes a minimum demand on the user's time and attention.

It is worth while to consider the above details of manipulation more fully, with a view to possible variations in the course of analytical work.

The first condition should be adhered to as strictly as possible. If, however, the liquid is delivered more slowly, the errors introduced will be much smaller for burettes of the specified times of outflow than for burettes of short delivery time. Moreover, the times of delivery fixed are quite long enough for almost all purposes, and it will rarely be desired to lengthen them still further. It is of course not feasible to keep the tap fully open when the end point of a titration is being approached. The fact that the last cubic centimetre or so is delivered quite slowly is in effect, however, simply an introduction of a short drainage time, and it has been pointed out previously that the delivery times have been so chosen that the rate of drainage is almost negligibly small. Also, in testing burettes the last cubic centimetre is necessarily run out slowly thus approximating to the conditions of an actual titration. It may also be desirable at times to add the reagent from the burette in small quantities at a time. If this is done by smartly turning the tap fully open and smartly closing it when the required fraction has been added, the total volume thus added, as indicated by the initial and final burette readings, will be in close agreement with the volume delivered by emptying the burette continuously from the initial to the final reading. This again is in virtue of the fact that the delivery times have been chosen sufficiently long. With quick delivery times very different results would be obtained in the two cases. It should further be pointed out that although the proposed delivery times are appreciably longer than those which it is customary to employ, yet by eliminating the necessity of waiting for drainage, the time occupied by a

titration is actually shortened in spite of the increased delivery time.

The second condition, given previously, that the reading should be taken immediately after the required amount of liquid has been taken from the burette, may be departed from within reasonable limits (say, 2 or even 5 minutes), to suit the convenience of the user. If the third condition is departed from and a reading other than the 0 c.c. mark is taken as the initial reading, only quite small errors will be introduced.

The Committee recommends that burettes should be made with delivery times in accordance with the National Physical Laboratory specifications and used in the manner described above.

The Committee recommends that a detailed account of the work of Mr. V. Stott on the use of pipettes and burettes shall be published in the Society's Journal.

Measuring Flasks.

The Committee calls attention to the dimensions of necks of graduated flasks set down in the pamphlet issued by the National Physical Laboratory.

Measuring Cylinders.

The Committee calls attention to the fact that only in the case in which the body of a measuring cylinder is made from tube is it possible to obtain anything approaching perfect uniformity of internal diameter. In cylinders blown in the mould the internal diameter invariably diminishes more or less sharply towards the bottom, and the walls are often irregular. The length of the bottom of a cylinder blown in a mould corresponding to 1/10 of the nominal capacity should not be graduated, as the readings over this range are likely to be inaccurate.

In reading the level of liquid in measuring cylinders attention is called to the method of observation described by the National Physical Laboratory. Unless proper precautions are taken widely different results can be obtained.

The following dimensions of cylinders are recommended for general use :—

Capacity, c.c.	Diameter, mm.	Height overall, stoppered, mm.	Height overall, unstoppered, mm.	Diamoter of foot mm.
5	13	—	110	35
10	15	—	125	35
25	20	200	200	45
50	24	240	200	50
100	31	290	240	60
250	41	380	330	75
500	52	480	380	95
1000	67	510	440	115
2000	82	610	500	130

Lamp-blown Apparatus.

The Committee considered the possibility of standardising lamp-blown apparatus. It was represented to it that if such pieces of apparatus as the Orsat gas-analysis apparatus were standardised, chemists would not experience the difficulty of replacing broken parts which existed at the moment. The Committee, however, was not in a position to undertake the enormous amount of detailed work which the fixing of standards would entail, but suggests that the matter might be taken up by the British Lamp-Blown Scientific Apparatus Manufacturers' Association. As no moulds are required in this work the case is somewhat different from that of the mould-blown hollow ware.

[Signed]
Morris Travers, *Chairman.*
J. P. Longstaff, *Secretary.*

July 12, 1919.

SOME CHEMICAL PLANTS IN THE COLOGNE AREA.

Part I.

A. J. ALLMAND AND E. R. WILLIAMS.

Last January and February we had occasion to visit certain chemical works near Cologne with a view to inquiring into their economic situation. During our visits we acquired the information and made the notes which form the basis of the present articles. It should be clearly understood in reading what follows that we had no authority to demand that the firms should disclose to us any secrets, or, indeed, any working details beyond those directly concerned with the matter in hand. Further, we only examined inorganic chemical manufacturing processes.

LEVERKUSEN WORKS OF THE FIRM FARBENWERKE (VORM. FRIEDRICH BAYER) ELBERFELD.

This well-known factory is situated hard on the east bank of the Rhine, a few miles north of Cologne. It is well over a square kilometre in area. Its lay-out has been planned on logical lines and everything is done on a lavish, not to say unduly expensive and elaborate, scale. Broad roads running N. to S. and E. to W. intersect it at frequent intervals. Water transport communications are excellent, as are railway facilities both inside and outside the works. The row of blocks of buildings next the river is devoted to the manufacture of so-called initial products or raw materials, comprising plants for sulphuric acid, hydrochloric acid and sodium sulphate, nitric acid, caustic soda (from sodium carbonate), caustic soda and chlorine (electrolytic), sodium sulphide, barium sulphide, sodium chromate, etc. Next comes a row of buildings for the manufacture of "intermediates," including derivatives of acetic acid, acetone, mercaptan, benzene, naphthalene and anthracene. Finally come the "end-products," comprising all kinds of coal-tar dyes, salicylic acid, sodium salicylate, phenacetin, lithopone, superphosphates, artificial rubber, photographic chemicals, papers and films and artificial sodium nitrate. The power-house contains four 2500 h.p. turbo-generators used for mechanical power and lighting, and five machines for the electrolytic alkali plant, each generating 4000 ampères at 220 volts. Before the war, they employed about 7500 workpeople (including 3000 mechanics) and 1500 salaried personnel (engineers, clerks, chemists, foremen, selling branch, etc.). A far larger number of workmen was employed during the greater part of the war, owing to extensive munition work (including poison gases).

Space will only permit us to describe a few of the more interesting plants.

Sulphuric acid and cement from waste calcium sulphate.

This plant is still in the experimental stage, though in one month as much as 1000 tons of sulphur trioxide has been produced. It originated in an attempt to dispose of the calcium sulphate press-cake resulting from neutralising the excess of sulphuric acid used in many organic sulphonation processes. All available dumping grounds in the neighbourhood had already been filled up. The process consists essentially of mixing the press-cake with coal and a slagging material and feeding it in at the upper end of a cylindrical revolving furnace, slightly inclined from the horizontal, and lined with a suitable refractory material. The two furnaces at present installed are about 50 metres long and 3 metres in diameter. They are coal-dust fired. The charge was stated to take about

three hours to reach the bottom end of the furnace. From there it drops into a second similar furnace of smaller diameter which acts as a cooler (air for combustion of coal drawn up through this?). The gases pass through dust chambers and an electrostatic dust collector (unsatisfactory) and are led to the sulphur trioxide converters. Practically no sulphur trioxide is produced in the furnaces. The slag is sent elsewhere to be ground. It was stated that the resulting cement was of good quality. Also that natural calcium sulphate had not been used. Gypsum had been tried, but the (briquetted?) charge broke up owing to water evolution. Anhydrite would probably prove suitable. The method had not been fully worked out, and trouble was sometimes experienced owing to the charge fusing and destroying the lining.

Synthetic nitric acid and sodium nitrate.

In this plant ammonia gas mixed with an excess of air is passed over a catalyst at a suitable temperature, and the resulting oxides of nitrogen absorbed either in soda solution or in water.

The ammonia was obtained in the form of a 20—25 per cent. aqueous solution from the cyanamide works at Knapsack, or from gas works, and the gas distilled off by steam in plant of normal design. At times ammonia liquor was not available, and the gas was generated by interaction of ammonium sulphate solution and lime water, driving off the ammonia by blowing in steam. The gas then passed to the furnace house, where it was mixed with air before entering the furnaces. This air had previously passed through a regenerator (10 ft. diameter by 18 ft. high), heated by the furnace gases, and the mixture entered the oxidiser at a temperature of 250° C. The oxidisers were more or less still in the experimental stage. Those seen were about 14 ft. in diameter and 18 ft. high and contained the contact mass—granular iron oxide plus some heavy metal oxide, all sieved through a 6-mesh sieve, in successive layers of 4—5 in. thick spread out on perforated tiles. The gases, containing 7—10 per cent. ammonia, entered tangentially at the top of the furnace and were evenly baffled through the catalyst, which was kept at a temperature of 700—800° C. A conversion of 80—85 per cent. to oxides of nitrogen took place, the losses being due to dissociation and combustion of ammonia, its interaction with nitrogen oxides, etc.

The nitrous gases passed through a cooler and then through one of several series of six absorption towers, down which passed saturated (usually filtered) sodium carbonate solution. The first of these was of granite, the remainder of wrought iron, and they were about 40 ft. high and 5 ft. in diameter. Great trouble was experienced owing to their corrosion and breaking down. The exact cause of this was never discovered nor where it was likely to break out. The plant could either be worked by passing gases through until the sodium nitrite formed was all converted into nitrate, or else by bringing about this conversion through subsequent addition of nitric acid. A solution containing about 350 grms. $NaNO_3$ per litre resulted, and this was concentrated in hot-jacketed shakers and crystallised out. The plant was capable of producing about 6000—7000 tons per month, which in its turn could supply the firm's nitre pots when working at full capacity.

Later in the war, nitric acid (40 per cent.) was made from these oxidiser gases, the capacity of the plant being some 1000—1500 tons monohydrate per month. For this purpose they were passed through 12 massive granite towers, each some 60 ft. high and 18 ft. in external diameter, arranged in two parallel series of six. Water or dilute acid from other towers passed down through the first five pairs and sodium carbonate solution down the last pair. The strong acid was drawn off from the third or fourth sets—it could not be predicted from which in practice. Acid of 47 per cent. strength was said to be the maximum possible. The towers were stated to be too wide—their absorbing area was not fully used. The weak nitric acid was concentrated by vitriol, steam and a proportion of hot burner gases being blown in. This plant was said to be unsatisfactory and to cause endless trouble with repairs. The vitriol was reconcentrated in a Kessler plant (about 20 small units).

Silico-ferron centrifugal pumps and pipes were largely used, though not too satisfactory.

The whole process is stated to be at present too costly (though it has a future). This plant in particular is in bad repair and will be shut down when ammonia stocks are worked off. In the meantime experimental work is being constantly done on it with a view to future improvements.

Electrolytic alkali and chlorine plant.

The cell room contained five lines, each of 60 Billiter-Siemens cells. There were also some Griesheim cells which had been installed about 18 years ago and which now are only of historical interest, though sometimes still used in consequence of the large number of Billiter cells that may be out of action at any moment. They take the same current as the Billiter cells, work at 3·8 volts, and the contents of the cathode compartments are drawn off every 30—36 hours.

Originally, the Billiter cells had been designed for 2000 amp., but it had been found that there were certain advantages in making three 6-inch holes in the brick partition wall between each pair of units in parallel, thus making a 4000 amp. unit. This consisted of a cast iron vessel about 10 ft.× 14 ft.×12 in. deep. The sides of this casing were lined with a chlorine resisting brick. A central brick bridge wall extended from end to end and served to support the covering slabs which were of Portland cement. Holes were cast in each slab to permit the passage of the graphite rods supporting the anodes. These slabs were luted into place with a mixture of tar and pitch. During the war, owing to the shortage of both tar and pitch, the luting was done with Portland cement.

The cathode consisted of a horizontal sheet of heavy iron wire gauze, supported about 4 in. above the cast iron shell and electrically connected to it. Upon the gauze was spread the diaphragm, which consisted of a paste of long-fibred asbestos and barium sulphate. Above this diaphragm and supported by graphite rods passing through the covering slabs, were the anodes. These anodes consisted of artificial graphite slabs about 26 in.× 7 in.×1½ in. These were drilled and tapped, and made a screw joint with the supporting rods (section 1×2 in.). Each unit was equipped with 80 such anodes.

Contact from the positive bus was made by a short length of flexible copper cable terminating in a lead cap which was cast over the projecting head of each graphite supporting rod. Contact to the negative bus was made directly through the iron casing.

An opening in the cover of each half-unit served for the inflow of brine. A central opening in the bottom of the casing, *i.e.*, in the cathode compartment, was connected by means of an iron pipe to an overflow syphon. At the end of the cathode compartment a glass level gauge was fitted, also an opening for the hydrogen outlet pipe. The chlorine left the cell by means of an earthenware pipe leading to a lead-lined chlorine main.

Below each line of cells was a channel having sufficient headroom for workmen, and the cells were supported over these pits by means of steel "I"

beams, from which they were insulated by porcelain knobs.

The cells were operated with a positive pressure of about 2 cm. of water on the cathode side, and a few mm. of water on the anode side. This positive pressure on the mains served to prevent any leakage of oxygen and also to show up any leakage, especially in the chlorine main and anode compartment covers.

The hydrogen produced was compressed into cylinders, and in this form some of it was sold. The greater portion however was used in the works for purposes of oxy-hydrogen welding or cutting.

In order to produce a chlorine of the purity required for many organic preparations most of the gas from the electrolytic plant was liquefied. It was first led into earthenware absorbers filled with strong sulphuric acid. The dry gas was then compressed in lead-lined gear-driven pumps, using a concentrated sulphuric acid in the compression cylinder. The compressed gas, at about 3 atmospheres, was condensed at a low temperature by means of an ammonia refrigerating plant. From the condensers the liquid chlorine passed into large steel receivers from where it was filled into smaller cylinders or piped directly to any required point in the works.

The catholyte contained 120 grms. caustic soda per litre about three days after setting the cell going, and this gradually rose to a figure of 160 grms. per litre at the end of three months as the diaphragm resistance increased. The voltage rose correspondingly, a figure of 4·3 volts being reached. The cells were cleaned out after four months.

The evaporator plant was originally designed to operate as four triple-effect vertical evaporators producing a liquor containing about 40 per cent. of caustic soda. Originally steam from the low pressure cylinder of the generator engines was used in the first effect. Better practice was later attained by using steam from the high pressure cylinder and two evaporators as a double effect. All the vertical type evaporators were fitted with salt filters. Owing to the corrosive effect of caustic stronger than 40 per cent., a smaller horizontal type evaporator without salt filter was used to complete the evaporation and to produce a 50 per cent. solution which was strong enough for the general purposes of the plant of the works.

The whole plant was working under a disadvantage owing to shortage and bad quality of materials. Much zinc and aluminium were being used instead of copper and the quality of the asbestos and of the graphitised anodes was poor. As a consequence, instead of producing 10,000 tons of chlorine per annum, for which it was designed, the output did not exceed two-thirds of this figure.

(To be continued.)

The Institute of Metals.—The autumn meeting of the Institute of Metals, to be held in Sheffield on September 24 and 25, will be the first occasion since 1913 that a gathering has been held outside of London. The attendance of many metallurgists and engineers from all parts of the world is expected, and in addition to the communication of papers there will be visits to works and a number of social entertainments. The papers will include: "Moulding Sands for Non-Ferrous Foundry Work," Prof. P. G. H. Boswell; Second Bellby Report on "The Solidification of Metals from the Liquid State," Prof C. H. Desch; "Observations on a Typical Bearing Metal," Miss H. E. Fry and Dr. W. Rosenhain; "Season Cracking of Brass," Dr. W. H. Hatfield and Capt. G. L. Thirkell; "The Ternary Alloys of Tin-Antimony-Arsenic," Dr. J. E. Stead; "Graphite and Oxide Inclusions in Nickel Silver," Dr. F. C. Thompson, and others.

THE MANUFACTURE OF FERMENTATION GLYCERIN IN GERMANY DURING THE WAR.

The investigations initiated by Lüdecke with the object of obtaining glycerin on an industrial scale by means of the fermentation of sugar assumed supreme importance in Germany after the outbreak of war, when the supplies of fat became enormously curtailed as a result of the imposition of the blockade. The extension of these researches and the conversion of the results obtained into the practical process of Connstein and Lüdecke were kept a close secret during the war, but were recently made known by Connstein at a meeting of the German Chemical Society, a report of which has appeared in the *Wochenschrift für Brauerei* (May 10, 1919).

The process is based on the observation that the percentage of glycerin formed from sugar is increased if the fermentation is allowed to proceed in presence of alkaline substances. Among the latter a special position is occupied by sodium sulphite, which yeast is able to withstand in very large proportions. Thus, a solution prepared from 10 litres of water, 1 kilo. of sugar, and 400 grams of the sulphite, together with ammonium sulphate, sodium phosphate and potassium salts, is completely fermented in a few days by 100 grams of yeast.

The process was worked by the Protol Company, and as many as 63 factories were at first pressed into the service, although only the few largest were finally retained, the monthly output of glycerin being about 1000 tons. Very serious practical and administrative difficulties were encountered at the outset, but these were ultimately overcome, and it was found possible to obtain 20 parts of purified glycerin, 27 parts of alcohol, and 3 parts of aldehyde from 100 parts of sugar. After removal of the yeast by filtration and of the alcohol and aldehyde by distillation, the bulk of the salts present are precipitated by calcium chloride and then by sodium carbonate, the liquid being afterwards neutralised with hydrochloric acid and filtered from the sludge formed; concentration and subsequent distillation yield a glycerin suitable for all technical purposes. As is the case with soap-works glycerin, the distillation of fermentation glycerin is sometimes complicated by the presence of trimethyleneglycol.

Neither the race of yeast, nor the nature of the sugar, nor the temperature prevailing during fermentation influences the yield of glycerin; raw sugar or even molasses is utilisable. At the termination of the fermentation the yeast exhibits certain changes in its morphological character, but still retains its fermentative capabilities; the worts used are, however, fatal to lactic and acetic bacteria.

With increase in the amount of sodium sulphite employed, the proportions of glycerol and aldehyde produced gradually increase, whilst those of alcohol and carbon dioxide continuously diminish; this is illustrated by the following experimental figures:

Sulphite employed	25	50	100
Glycerin formed ..	11.3	19.6	27.1
Alcohol ,, ...	40.	28.7	23 3
Aldehyde ,, ...	2.4	5.8	8.6
Carbon dioxide ,, ...	37.6	35.8	29.4

No information is available as to the cost of fermentation glycerin, and its economic manufacture in normal times would naturally depend on such questions as prices, supply of fats, etc. (See also this J., 1919, 175R, 230R.)

NEWS FROM THE SECTIONS.

CANADA.

The Ottawa Branch of the Canadian Section has recently drawn the attention of the Dominion Government to the extremely unsatisfactory nature of the proposed classification of chemists in the Civil Service now before Parliament; and at a meeting held on June 20 in Ottawa, which was attended by every chemical branch of the Civil Service, it was decided to prepare and present to the Government a statement in support of the above contention, pointing out the dangers attendant upon and the need for revising the suggested classification.

This statement has now been drawn up. It includes a table containing a number of cases where the chemical profession has been discriminated against in comparison with other professions, and it points out that such discrimination not only affects Civil Servants, but tends to set a low standard for the whole country by discouraging the best men from entering the profession, thus militating against the advancement of Canadian chemical industry in competition with other countries. A second table sets out anomalies in the classification within the chemical service, and the opinion is expressed that no measure of revision would make the classification satisfactory. Hence an entirely new scheme of classification was found to be necessary, and this has been drawn up and submitted for consideration. In each of the classes specified the duties, the qualifications and the rates of remuneration are set out. (*a*) Laboratory Assistants must possess a primary school education, and their salary scale should be £180, rising to £300 per annum. (*b*) Junior Chemists should have had a training equal to that obtained by a University graduate, with special training in chemistry; salary scale £370 to £420. (*c*) Assistant Chemists should have the same qualifications as (*b*) with the addition of three years' specialisation in advanced chemical practice; salary scale £450 to £540. (*d*) Associate Chemists should have the further qualifications of 5 years' experience as assistant chemist, familiarity with chemical literature, and ability to supervise and carry out original investigations; salary scale £550 to £650. (*e*) Chemists, who must also possess administrative ability; salary scale £660 to £840. (*f*) Chief Chemists, who should be able to direct and control a division of chemical work under the administrative head of a Department; salary scale £720 to £1000.

CHEMICAL ENGINEERING GROUP.

The first report traces the history of the group from the preliminary meeting in July 1918 down to the end of April last. The members of the provisional committee were elected to the first committee of the group in March 1919, and four new members and honorary correspondents from eight Local Sections were subsequently added. Sub-committees have been appointed to deal with finance, information bureau, standardisation of materials and fittings, and chemical engineering data sheets. The Rules, adopted at the inaugural meeting in March, were formally approved by the Council on April 30. The Council Sub-committee has recommended that the group be given direct representation on the Council, provided this would not conflict with the terms of the Charter. The number of members enrolled up to April 30 was 465, distributed as follows:—London 172, Manchester 46, Yorkshire 44, Glasgow 31, Liverpool 29, Bristol 24, Birmingham 19, Newcastle 17, Nottingham 13, Ireland 8, United States 6, India 6, S. Africa 4, Australia 3, Edinburgh 3, other countries, etc., 40.

PATENTS IN RELATION TO INDUSTRY.

At the invitation of the British Science Guild some couple of hundred of those interested in patents for inventions attended a conference at the Central Hall, Westminster, on July 31, to discuss this subject under the chairmanship of Lord Moulton. Little, however, was heard of the relationship in question, those who spoke being chiefly representatives of the several professional bodies who have lately been making representations to the Board of Trade on the subject of patent law reform.

Sir Robert Hadfield stated that the Federation of British Industries had that morning agreed to press the following views:—A longer term for the patent; access of the public to the file of correspondence between the examiner and the applicant which precedes the grant of the patent; an expert judge for trying patent actions; two years for prosecuting a patent application; dating the patent as of the day of issue; 50 per cent. reduction of fees. Several of these points are more or less conceded in the Bill now before Parliament, but Sir Robert did not say whether the concessions are satisfactory. He stated that the subject of an Empire patent is not to be pressed at present.

Mr. Walter F. Reid pointed out that in neglecting inventors the State was disregarding one of its most valuable assets. The poor inventor did not have sufficient opportunity; he was taxed at the time when all his resources were needed for the development of his invention. Cheap protection was the key to progress.

Mr. Hunter Gray followed on the side of the inventor. It was lamentable that the debate on the second reading of the Patent Bill in the House of Commons within the past few days should have been occupied almost solely with a discussion of the attempt of a certain Trust to capture an industry, without a word being said as to the deserts of inventors or the benefit of inventions. He advocated the appointment of a committee by the Government to take evidence from all parties interested, for the purpose of evolving a live Patent Law.

Mr. Douglas Leechman objected strongly to the scheme of "licences of right" which had been transferred to the new Bill from the old almost without alteration. The interest of industry should be the first consideration of patent law. The main burden of his song, however, was a moratorium for patents; extension of the term by two years was quite insufficient. He computed that 100,000 patents were in force on August 4, 1914; let them all have another five years' life on application made by the patentee. To say that some of them had been worked during the war so that it would not be fair to give them a further term, was absurd.

Mr. W. M. Morley supported Mr. Reid in his demand for a cheaper patent. The £100 spread over 14 years was a tax which the inventor ought not to be called upon to bear. The United States Patent cost £7 for 17 years. With Sir Robert Hadfield he would reduce the cost of the British patent by one-half. He approved the system of annual taxation after the first four years and would not like our Patent Office to be choked, as was that of the United States, with the corpses of patents alive in theory but dead in fact. He made out that of the average £300,000 per annum income of the Patent Office £173,000 was due to renewal fees, and if these were halved the £120,000 annual surplus would sink to £30,000, which he deemed sufficient.

Mr. James Swinburne lamented public indifference to this question, which had fifty times the importance of the Irish question. He would like to see the surplus of the Patent Office income and more swallowed up in the maintenance in each important town of a technical library as good as that at the Patent Office.

Sir G. Croydon Marks was primed with a piece of information which appeared to surprise some of the previous speakers. It was that the initial £5 paid for a patent will in future keep it in force for six years instead of four. This, he claimed, would make the British patent the cheapest in the world. He lauded the new Bill and urged that it should be thoroughly examined before Committee stage was reached at the end of October. He admitted that he would have liked the Bill to have contained a more generous treatment of war-bound patents.

Lord Moulton expressed surprise that so little had been said on the subject under debate. The apparent ill-success which had met, according to the speakers, the attempts of deputations to convince the Board of Trade of need for the advocated reforms, he attributed to the point of view of the deputations not being that of public interest. They must convince the public that Patent Law is in the interest of the public. It was well known that 50 per cent. of the patents granted was mere rubbish and had better be swept away. Indeed the worthless patent was a restraint on invention. This accumulation of rubbish made the public suspicious of patents. The system of renewal fees was good as having a certain purgative effect. Dealing with the legal definition of "inventor" he regretted that a party to whom the invention was communicated from abroad could be the patentee. A patent must not have too long a term, it must be at the public disposal at an early period, for the public would insist that patents must help trade, and not strangle it.

CORRESPONDENCE.

CHEMICAL COMPENDIA AND ABSTRACTS.

Sir,—In your last issue (p. 259 R) you kindly offered to place your correspondence column at the disposal of those who had opinions to bring forward on the now much-discussed question of English, or better still, Anglo-French chemical compendia. Answering Dr. Wynne's remarks at the Conference on the Inter-allied Chemical Federation—must we really again copy the Germans, and must we have an English Beilstein or Richter? Not if we can do better. And better will be the always-up-to-date lexicon, in the form of an adaptation of the well-known card-index system, as suggested to me about six years ago by a French chemist, Dr. R. Padova, of Marseilles.

A card index is indeed eminently suitable both for an organic and for an inorganic lexicon. Subscribers all over the world would receive every month new cards to keep it up to date by the insertion of new compounds or new cards to replace old ones, when the information conveyed by them had become obsolete. No new edition would be needed, but a standing committee of the Inter-allied Chemical Federation would be constantly revising the work, sending out new cards or simply gummed slips for correction purposes. An hour monthly is the maximum amount of time each librarian would have to spend to keep the index up to date. Such a work would be invaluable for research, as the student could always be sure to find even the latest information. The only objection to this scheme is that it would require a special piece of furniture in each library; a trifle for a reference compendium, and if the cards would take up more room than an edition of Richter, they would occupy less than two editions or more.

The cards could be printed in English, French, Italian, and even German, the chemical formulae used for the classification being international; and the method could be used for an index of literature, giving only the chemical and physical properties of the compounds, where and when described, etc., and also for a more readable compendium of literature selected by the most eminent Inter-allied chemists and according to the latest accepted opinions. There would also be room for a compendium of patent literature made on similar lines, for organic and inorganic chemistry, which, if classified by subjects and properly commented upon, should prove a more valuable work even than Friedländer.

—I am, Sir, etc.,

August 5, 1919. J. J. Bloch.

Sir,—The necessity for complete compendia of the Beilstein type and of sets of abstracts for rapid reference is obvious to anyone who has been engaged on any kind of chemical investigation. The question resolves itself into (1) the nature of the references, (2) the most economical method of production, and (3) deciding on the languages in which the references should appear.

In my opinion the original papers and consequently complete sets of journals cannot be dispensed with. It is a misfortune that they are so numerous and so costly; but I cannot agree with Sir W. Pope's suggestion, if I understand it rightly, that an "Alembic Club" selection should be made of the more valuable contributions to replace them. Who is to judge of the value of a paper, for one that appears worthless to one reader may contain the germ of an important idea to another? It is only through the perspective of Time that the intrinsic worth of papers can be judged and a selection made.

Granted then that all original papers are available, there is no more rapid method of reference than through a Beilstein's Handbook and Richter's Lexikon, and these should be compiled for both organic and inorganic chemistry and possibly for other branches of the science as necessity arises.

The arrangement of Beilstein and Richter so far as organic chemistry is concerned could not, I think, be improved upon. Conciseness makes for clearness, ease of reference and economy. The work could be done in co-operation, say through representatives of the participating countries acting as editors with their staffs of assistants working under one roof.

The building might be the one projected for a central library and reading room.

In regard to abstracts, the most economical method of dealing with them would be for contributors of papers to the Inter-allied Journals to be obliged to furnish their own abstracts, which, together with other abstracts, should be edited and published from the central bureau at stated intervals after the manner of the Zentralblatt.

This Zentralblatt would, like its German prototype, contain abstracts of every paper, including patent literature. The patent literature might be classified and republished *in extenso* in the form of Friedländer publications, not only for one, but possibly for different industries.

The question of language would, I think, be fully met by Sir W. Pope's suggestion of limiting publication to French and English. Every educated person of any nation can read one or other or both languages, and the cost would be greatly reduced by not extending the number.

Prof. Wynne's suggestion that the Allied Govern-

ments might contribute substantially to the cost of these publications as a graceful acknowledgment of the gratuitous services rendered by the chemists of the Allied countries is one deserving of serious consideration.—I am, Sir, etc.,

August 7, 1919. J. B. COHEN.

NEWS AND NOTES.

AUSTRALIA.

Queensland Mining Industry in 1918.—The annual report of the Under-Secretary for Mines states that the value of the mineral output for 1918 was £3,740,925, or £272,052 less than in 1917, a decrease chiefly due to the drop of the gold yield from £567,371 to £194,268. Older goldfields such as the Charters Towers persist in their decline but fair development results were obtained in Clark's Gold Mines. Mount Morgan sent 232,592 tons of siliceous ore to the concentrating plant and produced £335,431 worth of gold from 115,715 tons of copper ore, besides 6638 tons of copper—now its chief product. Throughout the Commonwealth copper fetched an average price of £110 per ton. The most important copper-producing centre, Cloncurry, gave an increased yield of 1814 tons over 1917, notwithstanding labour troubles, and contributed 12,003 to the total 18,979 tons of copper produced by the State. In the Herberton district the development of the Empress and Rio Tinto mines is proceeding.

At the height of the market in 1918 record prices of £280 16*s*. and £276 per ton were secured for tin concentrates with metallic contents of 71 and 73 per cent. respectively, but in December only £140 was offered for concentrates of 70 per cent. and over. Stimulated by the high prices the output of lode tin in the Herberton district substantially exceeded that of 1917.

The State produced 983,193 tons of coal of an average value at the pit's mouth of 11*s*. 7·7*d*. per ton, or 2·96*d*. more than in 1917; a lessened demand and the enforced stoppage of one of the collieries accounting for the decrease in output of 65,280 tons. A revival towards the end of the year improves the outlook for coal in 1918, but not for coke of which three-quarters of the quantity required in Queensland for smelting is supplied from New South Wales.

Investigations have been made during the year into deposits of marble, salt, terra-cotta, clays, pigments, and manganese, and an extensive area of coal of good quality has been proved. Numerous minerals have been examined in connexion with the proposed State iron-smelting works, and the Jibbinbar deposits near Stanthorpe have been selected for a State arsenic mine.—(*Bd. of Trade J., July* 3, 1919.)

SOUTH AFRICA.

The Alcohol Industry in Natal.—The production of spirits in Natal increased from 1,004,310 galls. in 1917 to 1,934,040 galls. in 1918, owing to the increased demand by the Imperial Government and the production of motor fuel. During August—December, 1918, vinegar makers purchased 4791 galls. of Natal spirits for conversion into vinegar. Exports during 1918 were 1,009,957 galls., against 432,665 galls. in 1917. The countries importing this spirit in increased quantities were: Argentina, Australia, East Africa and Madagascar.

The newly-established Union motor fuel industry at Durban consumed 476,939 galls. of spirits in 1918. The motor-fuel factory started operations in February, 1918, and by the end of the year had manufactured 255,158 galls., of which 4319 galls. was exported. All the ether manufactured by the firm was used for motor spirit, with the exception of 1300 galls. sold to chemists for anæsthetic purposes, and 1956 galls. exported.

The fuel industry is handicapped by the present high cost of denaturants abroad, and by the import duties of 20 per cent. *ad valorem* on pyridine and wood naphtha, which are used solely for manufacturing purposes. Unless the cost of these denaturants substantially decreases with the expected fall in the price of petrol, the future outlook in regard to the manufacture of Natalite is unpromising. The fact that it takes 5 galls. of 96 per cent. alcohol to manufacture 4 galls. of ether may lead to the consideration as to whether a new fuel containing less ether can be manufactured instead of Natalite (this J., 1918, 95 R, 177 R).

The quantity of industrial spirit used under rebate of duty down to 2*s*. per gallon in the manufacture of medicinal and toilet preparations, perfumery and flavouring essences, increased from 64,114 galls. in 1916 to 83,980 galls. in 1918.—(*Bd. of Trade J., July* 24, 1919.)

UNITED STATES.

Autumn Meeting of the American Chemical Society.—The 58th meeting of the American Chemical Society will be held in Philadelphia from September 2—6 inclusive. The membership of the Society has increased nearly twofold since 1914, and is now 13,600.

The sessions, which are to be held at the Bellevue-Stratford, will relate to problems of reconstruction growing out of developments which placed the American chemist so much on his own resources both for materials and apparatus with the closing of foreign markets. One of the features of the meeting will be the first session of the newly organised dye section. There will be a joint session of this section with the Division of Industrial Chemists and Industrial Engineers to consider a proposal to revise the patent law. It has been suggested that the charging of a nominal annual renewal fee would compel many patentees to work their patents, rather than to permit them to be idle for many years.

Special arrangements have been made to give to all delegates access to the chemical plants of Philadelphia, including the munition works on the Delaware River. The conversion of such establishments to the ways of peaceful industry will come up in various aspects before divisions of the Society.

The provisional programme is as follows:—September 2: Council meeting and dinner to Council by invitation of the Philadelphia Section. September 3: General meeting, with addresses by Mr. Newton D. Baker, Secretary of War, and others. September 4: Divisional meetings and President's address, by Dr. W. H. Nichols, at the Museum of the University of Pennsylvania. September 5: Divisional meetings and banquet in the evening at the Bellevue-Stratford. September 6: Excursions and automobile trip to Valley Forge.

Use of Lead Oleate in Rubber Manufacture.—In a certain rubber works an employee, trained in a linoleum factory, decided to use lead oleate to overcome stickiness just as he would if he were making linoleum or oilcloth. The result was very satisfactory and now one company contemplates using a million pounds of the oleate during the next twelve months.

Alcohol.—A bill has been introduced into Congress for the purpose of relieving distillers of industrial alcohol of the restrictions which have made production costs so high. Alcohol distilleries will be licensed and bonded under an approved plan and denatured alcohol sold tax free for domestic and foreign use. Alcohol without denaturants may be withdrawn tax free for the use of University and research laboratories and for hospitals

conducted without profit. It is intended that there shall be an ample supply of suitable alcohol for the development of dyes, pharmaceuticals, new fuels and for scientific work generally.

Electric Furnaces.—At the meeting of the American Institute of Chemical Engineers, held at Boston in June, most of the programme was devoted to a symposium on electric furnaces, with special reference to their use with brass. Five types came in for discussion, namely, the direct arc type, the vertical ring induction furnace, the granular resistor, reflected heat type, the stationary indirect arc and the indirect arc type with stirring of the melt. Elaborate data as to the performance of these electric brass furnaces were produced, and records with brasses of different composition submitted. Four years ago there were no electric brass furnaces in commercial operation, while to-day more than one hundred are either in use or being installed by some forty firms. The capacity of these furnaces ranges from 300 lb. to one ton.

By-product Coke-ovens Fired with Producer Gas.—A new coke plant has recently been put into operation at the Providence Gas-Light Company's works at Providence, R.I., where the ovens, 40 in number, are fired with producer gas in order to release the entire output of gas for other purposes. By this means a yield of more than 11,000 cub. ft. of coal gas per ton of coal carbonised is secured. The installation is interesting as suggesting to the iron and steel industry the substitution of blast-furnace gas for coke-oven gas in heating the coke ovens. Such a change would release the whole output of oven-gas for use in heating furnaces, soaking pits, and open-hearth furnaces. The Providence plant has demonstrated that as low a coking time can be secured with producer gas as with coke-oven gas.—(*Iron Age, May* 22, 1919.)

JAPAN.

The Future of the Wood Pulp Industry.—The production of wood pulp has increased very greatly since the wood from Karafuto (Saghalin Island) has been used in Japanese paper mills. In the first year, 1915, the output of pulp from this source was 4676 tons; in 1917 it reached 38,448 tons. The Government Forest Bureau has recently given the following estimates of wood pulp production in the immediate future (tons):—Saghalin, 143,500; Hokkaido, 151,042; Hondo (Central Japan), 102,522; Chusan (Korea), 15,000. Total, 412,046 tons. The following table gives more detailed information:—

District.	Species.	Present output. Tons.	Future production. Tons.
Saghalin	Sulphite pulp	38,448	143,500
Hokkaido	Sulphite ,,	22,048	47,115
	Ground ,,	48,777	103,909
Hondo	Sulphite ,,	19,037	20,623
	Ground ,,	40,729	81,999
Chusan (Korea)	Sulphite ,,	—	15,000
Total	Sulphite ,,	79,533	226,238
	Ground ,,	89,506	185,808
	Grand total ..	169,039	412,046

No mechanical pulp, soda or sulphate pulp are produced in Japan.

The war has had a profound effect on the paper industry, and exports have increased enormously. In 1917, 66,095,952 kin of paper, valued at 16,095,316 yen, was exported; in the same year 8,336,655 lb. of wood pulp, valued at 875,492 yen, was shipped abroad. On the other hand, the home demand for pulp—chiefly for use in Japanese hand-made paper —has increased but very little. The total domestic consumption of pulp in 1917 was 181,436 tons. Deducting this figure from the total estimated production in the near future, there results a probable surplus of 230,610 tons. There should be no difficulty in marketing this surplus, but at the moment the home paper market continues to droop. The continual arrivals of American paper, bought by Japanese importers before the armistice, is also disturbing the market. American newsprint is quoted at 8 yen per ream, and imported art paper at 29 yen per 100 lb.; the price of Japanese newsprint is 7·80 yen per ream, and printing paper even higher. Prices are expected to decline still further in view of the American shipments and the increasing home production. (Kin=1·33 lb., yen=2*s.* 0½*d.*)

GENERAL.

Patents and the Peace Treaty.—The Council of the Institute of Patent Agents draws attention to Articles 306—311 of the Peace Treaty, which allow extensions of time for the maintenance or obtaining of such patents, designs, trade marks, etc., in enemy and in Allied countries, which should have been accomplished during the war (see this J., 1919, 269 R).

The Institute of Chemistry.—At a meeting of Council held on July 25 a letter was read from the Department of Scientific and Industrial Research stating that the researches undertaken by the Vitreous Compounds Research Committee had now been transferred to the British Scientific Instruments Association. The Nominations and Examinations Committee reported the admission of 18 students and the election of 57 Associates, 5 Associates to Fellowships, and 17 Fellows. This Committee was empowered to accept applications from candidates for an examination in Biological Chemistry to be held in October next. On the recommendation of the Institutions Committee, the Hartley University College, Southampton, and the Sir John Cass Technical Institute were added to the list of recognised institutions. Sir William Tilden and Mr. A. Chaston Chapman were nominated to serve on the Consultative Council on Medical and Allied Services of the Ministry of Health. It was decided that the Proceedings of the Institute be issued six times in 1920, and that the tariff for advertisements be increased by 50 per cent. in view of the corresponding increase in circulation. It was also agreed to consider the advisability of adding a branch of agricultural chemistry and microbiology to the branches of examination for the associateship.

The British Photographic Research Association.—A report by the director of research, Dr. R. E. Slade, states that a wide programme of research has been drawn up and preliminary experiments have been made on a large number of the subjects mentioned in the programme (this J., 1919, 165 R). The history of photographic science and industrial development shows that, since the publication in 1891 of the researches of Hurter and Driffield, practically no new methods of attacking the problems of photography have been introduced. Many workers have improved and worked out further details of the old-established methods, and very considerable advances have been made, but the time now seems ripe for entirely new methods of photographic research. The Association is using all the means at its disposal to initiate such new methods, and is making progress in this direction.

Some experiments have been made on gelatin, which though not suitable for publication will be of great use in future work. Progress has been made in investigation of photographic emulsions and a communication on this subject will be available shortly. Success has been attained in staining wood black or grey right through. This black wood, which was made in Germany before the war,

is used by manufacturers of cameras and optical instruments, and the grey wood is used for picture frames and furniture. The process, for which an application for a patent has been filed, should be quite suitable for use on a large scale and quite economical. Two communications from the laboratory have already been published ("Contrast and Exposure in X-rays Photographs Through Screens," by R. E. Slade, and "The Fundamental Law for the True Photographic Rendering of Contrast," by A. W. Porter and R. E. Slade) and it is intended to publish without delay any results of research which are of general interest and not of immediate use for application to specific problems of the photographic industry.

Revised Atomic Weights.—The report of the International Committee on Atomic Weights for 1919—1920, the first regular report since 1916, is given in the July issue of the *Journal of the Chemical Society*. It records the results of comparatively recent work on the atomic weights of hydrogen, carbon, bromine, boron, fluorine, gallium, zirconium, tin, tellurium, yttrium, samarium, dysprosium, erbium, thorium, uranium, helium and argon. The only changes recommended for adoption are :—Argon 39·9, boron 10·9, gallium 70·1, thorium 232·15, and yttrium 89·33. It is further proposed that the figure hitherto adopted for nitrogen, 14·01, should be altered to 14·008, which is probably correct to within ± ·001.

A New Process of Carbonising Coal at a Low Temperature.—In a letter appearing in the *Times* of July 29, Lieut.-Col. H. Clarke directs attention to the Summers system of low temperature carbonisation of coking coals. He remarks that a process for the low temperature carbonisation of non-coking coals, with by-product recovery, is in successful operation in the United States. Recently, in conjunction with Dr. H. G. Colman, he has made a thorough investigation into the operation of a continuous horizontal coke oven whereby coking coal, rich in volatile constituents, is subjected to low temperature carbonisation, resulting in the production of fuel possessing a hard, dense and uniform structure. The basic principle of the oven is its continuous operation, brought about by the action of a reciprocating floor, which by its movement longitudinally in the oven automatically discharges the coke from one end and draws the coal from the bunker at the other. Owing to the pressure set up within the oven by the action of the floor, a heavy compression of the plastic coal takes place, the resulting coke possessing the before-mentioned qualities, which render the coke sufficiently hard to withstand without breakage its subsequent subjection to the process of screening, and to meet the requirements of transportation. The coke produced by other systems of low temperature carbonisation is soft and friable in character. Amongst other features of the continuous process are, the more rapid carbonisation than is the case in any intermittent process, the low labour charges incidental thereto and the high yield of by-products, more especially of light hydrocarbons suitable for motor spirit, and of heavy fuel oils. The oven is patented in Great Britain by L. L. Summers, and a plant for demonstration purposes is being erected in the United Kingdom.

Drugs During the War.—The National Health Insurance Commission (England) has recently issued a memorandum (Cmd. 183, 2*d*.) on the special measures taken by it in relation to the supply of drugs and other medical stores during the war. The former dependence of the British drug industry on imported chemicals and the alarming shortage experienced during the early days of the war are now matters of common knowledge, but the memorandum constitutes a useful summary and an ever-necessary reminder of the essential facts of that deplorable situation. It is interesting to note that 40 University and College laboratories which undertook the preparation of novocain and beta-eucaine succeeded in producing 350 lb. (7,000,000 doses) and 216 lb. (3,000,000 doses), respectively, of these local anæsthetics. At the present time, it is stated, there is hardly any medicinal chemical of importance which is not being made on a large scale in this country, and the following list is given of substances in which Germany formerly possessed a monopoly but which are now produced commercially in the United Kingdom :—Acetylsalicylic acid, salicylic acid, sodium salicylate, methyl salicylate, salol, medicinal liquid paraffin, potassium permanganate, thymol, phenacetin, novocain, eucaine, salvarsan, neo-salvarsan, paraldehyde, resorcin and lanolin.

The Royal Ordnance Factories, Woolwich.—The final report of the Committee of Inquiry on Woolwich Arsenal has recently been published, together with the first, second, and third interim reports, in the form of a White Paper (Cmd. 229, 3*d*.). The Committee reiterates its opinion that the administration of the Arsenal is in need of thorough re-organisation and the appointment of a board of management, together with reforms in the system of costing. In the first interim report (Nov. 6, 1918), the Committee recorded its opinion that "the present storage of explosives at Woolwich constitutes in a high degree a real and grave source of public danger." Over 10,000 tons of explosives was accumulated within an area of 1284 acres, and very large quantities of high explosives and cordite were stored in unprotected brick buildings with slate or corrugated iron roofs, under 10 per cent. of the buildings complying with the Home Office regulations. The second interim report (Nov. 22, 1918) recorded the finding of the Committee that Woolwich Arsenal should be retained as a Government arsenal for munition manufacture in peacetime, together with a dissenting report by Lord Marchamley who adduced strong arguments in favour of removing it elsewhere.

The Sugar Industry in Java.—Much capital has in recent years been invested in rubber plantations in Java, so that the cane industry has perhaps hardly developed to the extent anticipated. Still, the industry has certainly expanded considerably, especially when it is remembered that only a small proportion of the exceptionally fertile soil is under cultivation for cane. The total production of 218,000 tons in 1880 had advanced to 710,000 tons in 1900, and in 1918 it had reached 1,791,000 tons manufactured in 186 factories. This growth must be ascribed not only to the naturally favourable conditions and good cheap labour, but also to the scientific assistance given by excellently trained technical experts, who by introducing economic methods of extraction have increased the yield to such an extent that in 1918 it was no less than 4·36 tons of first quality sugar per acre. Since the home consumption is small most of the sugar is exported. The acreage under cane cultivation has been considerably reduced for the 1919 season.

Superphosphate Industry in Holland. — The shareholders of the Zeeuwsche Cooperatieve Kunstmestfabriek have resolved to build a superphosphate factory at a cost of about 1½ million gulden (£125,000).—(*Z. angew. Chem., June* 6, 1919.)

Phosphatic Deposits in Holland.—Scarcity of phosphatic fertilisers during the war led to searches being made at home. Deposits containing 25—30 per cent. of phosphate were found in the provinces of Drenthe and Overyssel, in north-eastern Holland. A large factory has been erected to wash and pulverise the mineral, and production was promised this spring.—(*U.S. Com. Rep., May* 12, 1919.)

British Zinc Ore for Belgium.—The Belgium Union of Zinc Smelters (Zinkhüttenverband) has entered into an agreement with English producers to obtain from them 100,000 to 150,000 tons of zinc ore during the next five years. Before the war Belgium imported 480,000 tons of zinc ore, from which 200,000 tons of zinc was produced.—(*Rotterdamsche Courant, June* 11, 1919; *Z. angew. Chem., July* 8, 1919.)

Sulphur Production in Italy.—American sulphur has not only expelled the Italian product from the American markets, but is competing now in those of Europe. The legal regulations designed for the protection of the sulphur industry have to a great extent failed in their purpose. The fall in output is shown in the following table:—

Production of Sulphur (metric tons).

Year	Crude	Refined	Ground
1910	430,360	169,093	171,570
1914	337,843	149,100	165,362
1915	358,107	116,358	140,414
1916	269,374	50,900	12,200
1917	211,847	71,585	44,320

(*La Finanza Ital.; Z. angew. Chem., June* 20, 1919.)

Phosphate Production in Tunis.—The output of the Phosphates de Gafsa Company fell last year to 572,696 metric tons (150,938 tons less than in 1917) in consequence of the lack of native labourers, whose number fell from 4550 in July 1914 to 1860 at the end of 1918. Exports, which have been facilitated by the increased tonnage arranged for by the Allied Governments, rose, however, by 245,761 tons to 720,193 tons, and a still larger export, involving further depletion of stocks, is expected for 1919.—(*Z. angew. Chem., June* 20, 1919.)

Nigerian Indigo.—The last issue of the *Bulletin of the Imperial Institute* (Vol. 17, No. 1) contains an account of experiments made on the native indigo plant of West Africa (*Lonchocarpus cyanescens*, Benth.), which is cultivated in plantations extending to several hundred acres in the southern provinces of Nigeria. In its natural state the plant is a climber, reaching a height of 30 ft., but under cultivation it becomes a bush 7 or 8 ft. high, owing to regular cutting. The results of the tests made at the Institute show that the method of treatment usually employed in India yields indigo containing the largest proportion of indigotin, *viz.*, 43·2—56·3 per cent., compared with 60 per cent. from good Bengal indigo. Ammoniacal treatment gave much less indigotin, *viz.*, 31·9—45·0 per cent., but double the amount of indigo paste. The ash content varied from 4·7 to 13·8 per cent. Two of the five samples tested contained no indigotin and the rest were insufficient in quantity to permit of dyeing trials or commercial valuation. The yield of indigo obtained from the leaves of the Nigerian plant was much less than that obtained in India from green plants of *Indigofera* spp.

A New Elmore Process.—The new Elmore process for separating mixed mineral sulphides consists of treating the ore or concentrate with hot strong sulphuric acid, which converts lead sulphide into lead sulphate, but has no substantial effect on zinc sulphide. The sulphate of lead is dissolved by means of hot concentrated brine.—(*Mining Magazine, July* 1919.)

Standardisation of Laboratory Glassware in Germany.—The Verein Deutscher Chemiker has formed a joint committee with manufacturers of glass, porcelain, and scientific instruments to investigate the possibilities of introducing standardisation into the construction of laboratory ware. Eight separate sub-committees have been appointed to deal with different branches of the subject. Attention is directed to the need of standardising laboratory apparatus, both from the point of view of economy in manufacture and the convenience of the user. The present high cost of raw materials, high wages, etc., make co-operation in manufacture imperative. Standardisation would mean fewer moulds for glassware, etc., uniform screw threads, fewer and smaller catalogues, less storage room, apparatus which could be readily interchanged, and, generally, manufacture of fewer items on a larger scale, and therefore at reduced cost.—(*Chem.-Z., June* 5, 1919.)

Development of the Polish Lead, Zinc and Copper Mines.—It is the intention of the French to further the development of important Polish mines, and for this purpose French engineers are at present stationed in the industrial regions of Poland. Lead and copper ores occur in the palaeozoic rocks in the region of Kielce, where copper is found in the form of azurite, copper green, malachite, copper pyrites, etc. Lead ores are found over an extended region and occur throughout a great part of the Lysagora range. During the war, the lead mines of Kielce and the copper mines in the region of Miedziana were restarted by order of the Austrian military authorities. The zinc and copper ores occurring in the Trias limestones in the region of Olkusz have for many years been the sources of supply to the zinc smelting works at Bendzin and Dombrowa, and the copper smelting works at Friedrichshütte near Tarnowitz, respectively.—(*Z. angew. Chem., June* 27, 1919.)

French Control at Ludwigshafen.—The Allied authorities at Ludwigshafen demand the recommencement of work at the dye factories under threat of penalties. This has not been possible until now owing to the need of repairs and to insufficient supplies of raw materials. Another obstacle is the control exercised by the French officers and civilians (almost exclusively chemists) which, if continued when the works are restarted, will mean the surrender of all secret processes, for it extends to the taking of photographs and to the eliciting of trade secrets from the workmen. Herr Erzberger has made a strong protest to the Allied authorities against the attempt to exercise constraint on the dye industry and against the procedure adopted by the French.—(*Z. angew. Chem., June* 17, 1919.)

The German Potash Industry.—The position of the German potash industry was reviewed at a general meeting of the A.-G. Deutsche Kaliwerke. It was remarked that the cession of Alsace-Lorraine subjects the industry to keen foreign competition which must be neither overestimated nor undervalued. While France lacks the large organisation necessary for the exploitation of the Alsatian deposits, it must be realised that they are extremely valuable, and that France has the support of her Allies. During the war America has built up a potash industry at considerable cost, and it has been decided that every American purchaser of imported potash must at the same time purchase a corresponding amount of the home product. Competition is also to be anticipated from Spain, and in all probability from other countries. To meet such competition the German potash industry must enter into agreements with foreign purchasers, and the industry must be united in its efforts. The German industry should be capable of producing and marketing 20 million double hundredweights yearly, compared with 12 million before the war. Production must be increased and cheapened in all ways—by scientific investigation, by combination throughout the trade, and various other means. Despite the fact that Germany no longer possesses a monopoly, the outlook in the potash industry is therefore not without hope. A dividend of 7 per cent. was confirmed.—(*Z. angew. Chem., July* 8, 1919.)

PERSONALIA.

Sir William H. Beveridge has been appointed Director of the London School of Economics.

The death is announced of Prof. H. W. Ward, in his 61st year, professor of physics at the Canning College, Lucknow, since 1889.

Prof. A. K. Huntington, who recently resigned the chair of metallurgy at King's College, London, has been granted the title of Emeritus professor.

Dr. E. Knecht has been appointed associate professor in technological chemistry, and Mr. D. J. Wood lecturer in physical chemistry in the faculty of technology at Manchester University.

The Council of Armstrong College, Newcastle-on-Tyne, has appointed Lieut.-Col. Sir Theodore Morison principal of the college in succession to Sir Henry Hadow.

Dr. Samuel Smiles, assistant professor of organic chemistry at University College, London, and co-secretary of the Chemical Society, has been appointed to the new chair of organic chemistry at Armstrong College, Newcastle-on-Tyne.

The chair of chemistry at Queen's University, Belfast, vacant through the death of Prof. E. A. Letts, has been filled by the appointment of Dr. A. W. Stewart, lecturer on physical chemistry in the University of Glasgow.

H.M. the King has been pleased to approve of the appointment of Prof. G. G. Henderson, professor of chemistry in the Royal Technical College, Glasgow, to the Regius chair of chemistry in the University of Glasgow. At the same university, Dr. T. S. Patterson has been appointed to the Gardiner chair of organic chemistry, and Dr. E. P. Cathcart, professor of physiology in the London Hospital Medical School, to the Gardiner chair of physiological chemistry.

Mr. Andrew Carnegie died on August 11 at Lenox, Massachusetts, in his eighty-fourth year. He will be remembered by chemists for the part he took in the commercial development of the iron and steel industry of the United States, and for his large benefactions to public libraries and education. The total amount of his benefactions was estimated at over £65,000,000 in 1908.

LEGAL INTELLIGENCE.

Liability for Damages Due to an Explosion. *Belvedere Fish Guano Co., Ltd., v. Rainham Chemical Works, Ltd. Ind, Coope and Co. v. Same.*

On July 24, before Lord Justice Scrutton in the King's Bench Division, the Belvedere Fish Guano Co., Ltd., brought an action against the Rainham Chemical Works, Ltd., for damages to its works arising from an explosion at the latter's factory in September 1916. Defendant company denied liability on the ground that it was acting as an agent for the Ministry of Munitions. Further, there was no danger involved in the manufacture and no evidence to show negligence.

The hearing was continued on July 25 and 28, and on July 30 his Lordship gave judgment. The substance which actually exploded was dinitrophenol which was being used for the manufacture of picric acid by a new process. The substance was by itself comparatively safe and stable, but under the influence of fierce heat it became a powerful explosive. There was no evidence before him as to what was the cause of the fire which broke out, but it may have been due to a workman smoking. Near the dinitrophenol was stored some nitrate of soda, boxes of which would burn fiercely if ignited. The fire originated in the room where these articles were stored, and it was clear that enough was known of the dangerous character of dinitrophenol for the works manager to warn the men to run for their lives, and the explosion followed almost immediately. In his opinion this came under the head of a dangerous trade involving the use of dangerous ingredients. He thought it was being carried on by Messrs. Feltman and Partridge as principals, the defendant company being its agent, and he decided that plaintiffs were entitled to recover against these three defendants.

In the second action by Ind, Coope and Co., a similar judgment was given against the same defendants but in favour of the other defendants on the record.

PARLIAMENTARY NEWS.

HOUSE OF COMMONS.

Alcohol Motor Fuel.

Mr. Bonar Law informed Mr. Manville that the Report on Alcohol Motor Fuel has been referred to the Department of Scientific and Industrial Research, with special reference to Recommendation No. 17 dealing with the suggested permanent organisation for encouraging and developing the production and utilisation of power alcohol within the Empire.—(July 23.)

Nitrogen Products Committee.

Replying to Capt. W. Benn, Mr. Hope stated that the report of this Committee has been received and was under consideration, as also was the question of publication. He was not aware that other countries are already establishing factories and availing themselves of the investigations made by this Committee.—(July 23.)

Patents and Designs Bill.

In the Patents and Designs Bill, 1919, the second reading of which was moved by Sir A. Geddes, it is proposed (in clause 1) that a British patent shall be deemed to have been abused (1) if it is not worked on a commercial scale within four years of the grant; or (2) if the working is hindered by importation from abroad; or (3) if the British demand is not being met; or (4) if the refusal of the patentee to grant licences is prejudicial to trade; or (5) if trade is prejudiced by the conditions imposed by the patentee. If abuse of a patent has been established the comptroller may grant a "licence of right" to applicants desirous of using it. A licensee may call upon the patentee to prevent infringement; if the invention is not being worked on a commercial scale and the patentee does not provide the capital necessary to work it, an exclusive licence may be granted to an applicant who can furnish the capital; if the powers specified prove to be ineffective the patent may be revoked. Clause 2 proposes that any patentee may declare his patent to be a "licence patent" and have it endorsed "licence of right"; and that the terms of such licence should be based upon benefit to the country and encouragement to the inventor. Clause 6 proposes to extend the duration of patents, and of licences under the patents, from 14 to 16 years; and under clause 7 the term of prolongation is not to exceed 5 years, or in exceptional cases 10 years, instead of 7 and 14 years as heretofore. Clause 11 reads:—

"(1) In the case of inventions relating to substances prepared or produced by chemical pro-

cesses or intended for food or medicine, the specification shall not include claims for the substance itself, except when prepared or produced by the special methods or processes of manufacture described and claimed or by their obvious chemical equivalents: Provided that in an action for infringement of a patent where the invention relates to the production of a new substance, any substance of the same chemical composition and constitution shall in the absence of proof to the contrary be deemed to have been produced by the patented process.

"(2) In the case of any patent for an invention intended for or capable of being used for the preparation or production of food or medicine, the comptroller shall, unless he sees good reason to the contrary, grant to any person applying for the same, a licence limited to the use of the invention for the purposes of the preparation or production of food or medicine but not otherwise; and in settling the terms for such licence and fixing the amount of royalty or other consideration payable, the comptroller shall have regard to the desirability of making the food or medicine available to the public at the lowest possible price.

"Any decision of the comptroller under this subsection shall be subject to the appeal of the court."

This section shall apply only to patents applied for after the passing of the Act.

Clause 18 prescribes regulations for the registration of patent agents, who hereafter must be British subjects.

The debate, which was attended by 35 members, was largely devoted to discussing the monopoly possessed by a firm of boot and shoe machinery makers which, it was stated, was controlled by an American company. Sir W. Pearce expressed the opinion that Clause 11 was a great improvement from the point of view of chemical industry. The Bill was read a second time and committed to a Standing Committee.—(July 28.)

The Trade Marks Bill.

In moving the second reading of this Bill, Sir A. Geddes explained that it provided for the registration of two classes of trade marks. Part A will include all existing trade marks and such as may in future be registered under the provisions of the principal Act. Part B is intended to include trade marks which are good property and in common use but which cannot be registered under the principal Act, and also marks removed from Part A under the provisions of the Bill. Registration in Part B shall be *primâ facie* evidence that the owner has the exclusive right to the trade mark, but no relief will be granted to its owner if the defendant establishes to the satisfaction of the Court that he (the defendant) does not deceive. Clause 6 is designed to deal with the abuse of the words "trade mark." In the past the registration of the name of a substance, *e.g.*, a drug, as a trade mark has secured a permanent continuation of the patent protection. To prevent this, it is proposed that if any substance manufactured under a patent be registered as a trade mark by the name or only practicable name for it, all rights to the exclusive use of the mark shall cease when the patent expires or is revoked. The Bill was read a second time.—(July 28.)

Sugar Imports.

The President of the Board of Trade informed Sir A Fell that the imports of sugar into the United Kingdom in 1918 had been as follows (cwts.):—Refined, 431,027; unrefined: beets 153,836, cane and other sorts (mainly maple sugar) 25,528,146. Total, 26,113,009. Glucose: solid 208,038; liquid 169,583. Invert sugar is recorded as glucose.—(July 28.)

The Peace Treaty.

The Royal Assent was given to the Treaty of Peace Act and to the Anglo-French Treaty (Defence of France) Act.—(July 31.)

Import Restrictions.

Mr. Bridgeman, in answer to Mr. Cantley, said that the Committee appointed to represent the chemical industry to advise the Department of Import Restrictions of the Board of Trade consists of official representatives of that Board and of the Ministry of Health, together with: Mr. T. D. Morson and Mr. R. H. Bewick, of the Association of British Chemical Manufacturers; Mr. W. F. Reid, of the Society of Chemical Industry; Mr. E. White, of the Pharmaceutical Society; Mr. T. E. Lescher, of the Drug Club; and Mr. W. Mann, of the British Chemical Trades Association.—(July 31.)

Peat and Oil in Ireland.

Mr. Macpherson, replying to Sir M. Dockrell, said that the Irish Peat Inquiry Committee appointed by the Fuel Research Board has presented its report, which is now under consideration by the Government. There is no evidence of the existence of natural oil in Ireland in paying quantity.—(Aug. 1.)

Exports.

In reply to a question by Col. Burdon, the President of the Board of Trade specified the countries which are now importing British coal and the chief exports which are being obtained from them, as follows:—

France.—Wines and spirits, silk manufactures, wood, leather, chemical manufactures, fancy goods. *Italy.*—Hemp, silk fabrics, fruits and vegetables. *Spain.*—Iron ore, lead, copper, fruit and vegetables. *Sweden.*—Timber, wood pulp, iron, paper, iron ore. *Norway.*—Wood pulp, timber, paper, fish. *Denmark.*—Eggs, butter, bacon. *Egypt.*—Cotton, cotton seed, onions, eggs. *Algeria.*—Iron ore, zinc ore, vegetable fibres for paper making. *Argentine.*—Grain, meat, hides, butter, linseed, dyeing and tanning materials and extracts.—(Aug. 4.)

Munition Chemists' Salaries.

In reply to Mr. Sitch, Mr. J. Hope said that an increase in salary was refused to the chemists employed at H.M. Factory, Oldbury, because they were at least as well paid as chemists employed at other Government factories, and that it was impossible to discriminate; and in answer to Mr. R. Young, he said that he had no reason to doubt that the memorialists for an increase in salary included at least 100 Associates and Fellows of the Institute of Chemistry; that he fully realised the admirable work done by munition chemists; that the statements made by a Departmental officer to the effect that the question of principle raised in the memorial could not be admitted by the Ministry of Munitions, and that the latter objected to the holding of meetings by the staff to consider such matters, must not be taken to be the considered view of the Ministry.—(Aug. 5.)

British Dyestuffs Corporation.

Sir Philip Magnus asked the President of the Board of Trade if the shares in this company subscribed for by H.M. Government represented new money, or whether they were allocated in consideration of the £1,142,000 loaned by the Government at 4 per cent. to British Dyes Ltd.

Sir A. Geddes replied that the sum advanced to this company had been repaid, and that H.M. Government had subscribed for the shares in the amalgamated company instead.—(Aug. 6.)

OFFICIAL TRADE INTELLIGENCE.

(From the Board of Trade Journal for July 24 and 31.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 73, Basinghall Street, London, E.C. 2, from firms, agents or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

Locality of Firm or Agent	Materials	Reference Number
British India (Bombay) ...	Iron and steel, galvanised sheets and tubes, pig lead, zinc slabs, tinplate, copper, brass, tin, aluminium, asbestos	200
Trinidad ...	Glass, earthenware, tin ...	204
British Malaya ...	Iron and steel, pharmaceutical preparations ...	272a
Canada	Galvanised iron, copper, brass and zinc sheets, tinplate, tin oxide, ceramic chemicals ...	269
New Zealand ...	Paper, leather	270
South Africa ...	Asphalt mastic, bitumen, bituminous paint ...	209
,,	Mining chemicals, dyes, paints, bottles, rubber	272
Belgium ...	Industrial and pharmaceutical chemicals ...	212
,,	Pharmaceutical products	221
,,	Chemicals, scientific instruments	229
,,	Chemicals, drugs, mantles, glue, non-ferrous metals	231
,,	Chemicals, starch, dextrin, oils, paint, varnish drugs, perfumery, fertilisers, metals, cement, plaster, soap, margarine, ultramarine ...	*3742, 4107, T & R
Bulgaria ...	Chemicals	275
,,	Metals	278
,,	Oils for soap manufacture, caustic soda, bottles, paper	280, 285
,,	Gelatin, glue, shellac, varnish, iron wire, tinplate, soap	281
,,	Copper sheets	282
,,	Caustic soda, glycerin, vaseline, castor oil, palm oil	283
,,	Fertilisers, machine oils, sulphur, copper sulphate, iron wire ...	284
France	Calf, box-calf, kid leathers	287
,, ...	Oils, essences	288
,, ...	Chemicals, dyes, aniline oil	289
France and Colonies	Cottonseed oil	242
Italy	Chemicals, electrical material	291
Netherlands ...	Non-ferrous metals, tinplate, galvanised sheets	246
Spain	Pharmaceutical products	248
Spain and Morocco	Drugs	249
Switzerland ...	Chemicals, drugs ...	252
,, ...	Edible oil, lard, starch ...	298
,, ...	Chemicals	299
Tripoli	Dyes, pigments, drugs ...	301
Japan	Chemicals, drugs, dyes, gelatin, glue, paper, rubber, asbestos, tinplata	302
United States ...	Drugs	260
,, ,, ...	Chemicals, drugs, dyes ...	262
Argentina ...	Aniline dyes	304
Brazil	Cement	265
,, ...	Chemicals, glass, crockery	266
Peru	Chemicals, china, earthenware	268

* Belgian Trade and Reconstruction, Department of Overseas Trade, Regent House, Kingsway, W.C. 2.

TARIFF. CUSTOMS. EXCISE.

Australia.—The import of foreign dyes to the extent of six months' supply will be permitted in cases where the same dye of British manufacture or an effective British substitute is non-existent or produced to an inadequate extent.

British West Indies.—It is proposed to unify the customs laws and duties in the whole of the British West Indies including British Guiana. The minutes of the proceedings of the conference may be inspected at the Department of Overseas Trade.

Canada.—The new rates of customs duty on rolled iron and steel, and cast steel when of greater value than 3½ cts. per lb., are 7½% *ad. val.* under the British Preferential Tariff and 12½% *ad. val.* under the Intermediate and General Tariffs.

China.—Goods shipped from the country of export after August 1 will be subject to the revised tariff.

France and Algeria.—Among the articles the export and re-export of which are again prohibited, except under licence, are condensed milk, margarine, oleaginous fruits and seeds, fixed vegetable oils and fats, soap, and sugar.

The prohibition of importation has been abolished in respect of potash, coal-tar dyes and intermediates, perfumery, etc.

The customs surtaxes have been abolished and a system has been substituted whereby the tariff rates of duty are to be multiplied by a figure known as "co-efficient of increase" which represents the relation which the official valuation of the goods in question made in 1918 bears to that of 1913. The co-efficient varies from 1·1 to 3; certain articles, including some iron alloys, certain chemicals, and optical instruments, are exempt from increase of duty.

Guatemala.—The new customs tariff is set out in the *Bd. of Trade J.* of July 24.

Italy.—Goods exported from the U.K. should be accompanied by a certificate that they are of British origin, as the special arrangement between the U.K. and Italy does not apply to articles shipped from the U.K. which are not the produce or manufacture of the U.K. It is advisable for U.K. exporters to obtain from the Italian importer before despatch of the goods an assurance that the import regulations have been complied with.

Morocco.—The new tariff valuations may be seen at the Department of Overseas Trade.

Netherlands.—The import duties on chloral-hydrate, chloroform, sulphuric ether, acetic ether and collodion have been increased as from May 23.

Portugal.—A surtax of 30 centavos per kilo. has been levied on imports of tin and its alloys, and one of 20 centavos per kilo. on exports of tin ore, as from June 28.

Russia (Northern Territory).—Import licences are again required for goods shipped after July 7.

Sierra Leone.—The revised export duties on palm kernels, palm oil, and kola nuts are: Palm kernels, £1 2*s.* 6*d.* per long ton; palm oil, £2 1*s.* 8*d.* per long ton; kola nuts, 4*s.* 8*d.* per cwt.

Spain.—Recent customs decisions affect cotton-wool, cotton yarn, wool waste, millet, manufactures of rubber and of buffalo skins.

Sweden.—The Government proposes to establish a sugar import monopoly.

United States.—On and after September 1, licences will be issued for the import of pig tin, alloys of tin, tin oxides, type metals, antifriction metals, waste metals, and other metals containing tin, from points other than points of origin and without reference to the date of shipment.

GOVERNMENT ORDERS AND NOTICES.

FOREIGN TRADE.

The Board of Trade has issued a Memorandum (Cmd. 274, 1*d.*) on trading conditions since the raising of the blockade. It is no part of the policy of H.M. Government to discourage British traders from competing in the German market, and it is very desirable that they should at once make every effort to secure a proper footing in Central Europe.

Exports.—Any goods may be sent to Germany without licence except such as are on Lists A and B of Prohibited Exports; export licences for the latter are to be obtained at the Export Licence Department, 1, Queen Anne's Gate Buildings, Westminster, S.W. 1. Goods sent to the occupied Rhineland through Holland need no longer be consigned to the Standard Bank of S. Africa at Rotterdam.

Imports.—Importation of goods from Germany is placed on the same footing as importation from all other foreign countries, but individual licences issued under the Prohibition of Import Proclamations are not available for goods of German origin.

Other transactions.—Other transactions of a commercial or financial nature with firms in Germany are permissible without further licence, provided they do not involve :—(*a*) the payment of money arising out of pre-war transactions; (*b*) the delivery of or dealing with property held in this country for persons in Germany since before the outbreak of war; (*c*) the transfer of securities by or on behalf of a person in Germany; (*d*) the allotment or transfer of securities issued by a company to or for the benefit of a German subject; (*e*) the transfer of any debt or other obligations due to a person in Germany.

The Memorandum also contains regulations and directions concerning trade with the territories formerly included in the Austro-Hungarian Dominions, Turkey and Bulgaria, Norway, Sweden, Denmark, Holland and Switzerland, Poland, Finland, Esthonia, Lettland and Lithuania.

EXPORTS.

Export restrictions.—Rennet powder, rennet extract and other preparations of rennet have been transferred from List A to List C.

Exports to Poland.—The Board of Trade learns from a semi-official source that permission is not required from the Polish Government for the import of printing and lithographic dyes, aniline dyes, borax, raw celluloid, chalk, kaolin, sand, potash, photographic materials, emery and carborundum in powder, graphite crucibles, laboratory and apothecary glassware.

IMPORTS.

Import restrictions.—General licences for formic acid and lithopone have been revoked.

Consolidated List.—A revised consolidated list of import restrictions was issued with the *Board of Trade Journal* of July 31.

Paper.—Rules have been issued by the Paper Imports Registration Department (23, Buckingham Gate, S.W. 1) which are to be observed by applicants for proportionate licences to import foreign paper and board in respect of British purchases.

NEW ORDERS.

The Minister of Munitions has issued the following Orders suspending the pre-existing Orders :—

The Iron Ore Mines, Cumberland and Lancashire (Suspension) Order, 1919. (July 24.)

The Potassium Compounds (Complete Suspension) Order, 1919. (Aug. 1.)

The Glass Control (Consolidated Suspension) Order, 1919. (Aug. 1.)

The Optical Munitions (Suspension) Order, 1919. (Aug. 1.)

REPORT.

REPORT OF THE INTER-DEPARTMENTAL COMMITTEE ON THE EMPLOYMENT OF GAS AS A SOURCE OF POWER, ESPECIALLY IN MOTOR VEHICLES, IN SUBSTITUTION FOR PETROL AND PETROLEUM PRODUCTS. *Petroleum Executive.* [*Cmd.* 263. 1*s.*] (*London: H.M. Stationery Office.*)

An inter-departmental committee was appointed in November 1917 to report upon (1) the employment of gas in substitution for petrol and petroleum spirits as a source of power, especially in motor vehicles, and the manner in which such gas may be supplied, stored, carried and used, with due regard to the safety of the public, and (2) the action, if any, which should be taken by H.M. Government to encourage and safeguard the use of gas for this purpose. After the publication of the interim report last year (this J., 1918, 186 R), an expert subcommittee was set up to investigate questions connected with the commercial use of gas for traction purposes in containers at high pressures, and with portable gas generating plants.

The Committee reports that gas traction is as safe as any other system of mechanical traction, even when flexible containers are used. Semi-rigid containers made of rubber and canvas are unsatisfactory. Metal cylinders composed of high carbon or certain alloy steels may be safely employed for working pressures up to 2250 lb. per sq. in. and their use should be encouraged. The average traction equivalent of 1 gallon of petrol is 250 cub. ft. of ordinary town gas. The total cost of compression into cylinders will vary between 1*s.* 8*d.* and 3*s.* per thousand cub. ft. of free gas, and will involve an average expenditure of 7*d.* per gall. on any petrol replaced. Model regulations for any gas-compressing or cylinder-charging establishments are appended to the report. With regard to admixture and control of the gas and air, the opinion is expressed that the closest approach to uniformity of mixture is secured with a non-variable area for air admission, the volume of air admitted after initial setting being determined by piston-speed. The gas supply should be positively controlled. Under these conditions, the following numbers indicate the relative power yields obtainable, after proper initial adjustment, from a motor vehicle engine unaltered structurally as regards the compression space :—Working on petrol, 100; on town's gas (450 B.Th.U. gross per cub. ft.), 91; on suction producer gas, partly hydrogenated with water gas (210 B.Th.U. gross), 87; on suction producer gas (140 B.Th.U. gross), 82.

The report points out that in the event of an attempt to establish a monopoly of motor spirit, any consumer for traction purposes of not less than 80,000 galls. a year has the commercial alternative, where supplies of town's gas are not available at a moderate price, of making his own gas. Details of a fully automatic system for this purpose are given. The risk of escape of unburnt carbon monoxide from a suction gas producer on a motor vehicle calls for no special precautions except when the vehicle is at rest within a closed structure, with the fire in the producer still burning. The weight of generator and accessories for a 30 b.h.p. engine is about 220 lb. The fuel cost of such generators with coke at 45*s.* per ton or anthracite at 55*s.* per ton is equivalent to petrol at 5.4*d.* per gall., one cwt. of coke or anthracite being on the average equivalent to 5·6 galls. of petrol for road traction purposes. With petrol, an efficiency of 1·33 ton-miles per penny is secured; the corresponding figure for coke employed in a suction gas producer is 7·5 ton-miles per penny. Suction gas, either alone or hydrogenated with water gas, should prove a suitable alternative

fuel for use in internal combustion engines designed primarily to run on alcohol. The use of liquefied hydrogen, methane, carbon monoxide or ethylene for traction purposes is commercially impracticable. Provided calcium carbide is available at a price not exceeding £5 per ton, there are commercial possibilities for the use of acetylene for purposes of enriching suction gas employed for traction purposes. The Committee considers that the employment of naphthalene for a similar purpose should receive attention. A reprint of the interim report accompanies the present report.

TRADE NOTES.

BRITISH.

Gambia. The principal articles of export from Gambia in 1917 were groundnuts, hides and palm kernels. The groundnut crop was above the average, 74,300 tons, valued at £869,790, being shipped in 1917, as compared with 46,366 tons, valued at £506,098, in 1916. The good prices obtained resulted in an increase in the acreage planted. Of the total crop 56,839 tons, or 76 per cent., went to the United Kingdom and 15,892 tons, or 21 per cent., to France. The export of hides constituted a record, being 101,120 tons, valued at £58,591, as compared with 26,946 tons in 1916 valued at £10,019, and of this the United Kingdom took about 98 per cent. The export of palm kernels decreased from 669 tons, valued at £14,671, in 1916, to 532 tons, valued at £7994, in 1917. With the exception of 4 tons shipped to France, all the kernels went to the United Kingdom. Exports of wax, ivory and rubber from Gambia are now negligible.—(*Col. Rep. Ann. No.* 979, *Feb.* 1919.)

Gilbert and Ellice Islands.—The tonnage and value of the exports of phosphates from the Gilbert and Ellice Islands are given in the following table:—

1913–14	1914–15	1915–16	1916–17	1917–18
203,493 tons	153,906 tons	128,440 tons	95,688 tons	82,845 tons
£305,000	£229,960	£128,410	£95,688	£82,845

Experiments carried out at the Ocean Island Experimental Station have shown that the phosphate deposits which lie below the top soil are not only useless but may be detrimental to cultivation in the crude (fossilised) state.

The exports of copra from the islands show an increase from 4,500 tons in 1913-14, valued at £45,000, to 5,485 tons in 1917-18, valued at £63,465.—(*Col. Rep. Ann. No.* 995, *May*, 1919.)

Bahamas.—The imports into the Bahamas in 1917 were valued at £493,584, made up as follows:—United Kingdom 8·7 per cent., Canada 0·6, British Possessions 5·7, America 84·2, and other countries 0·8 per cent. The exports were valued at £402,477, of which 11·9 per cent. went to the United Kingdom, 72·1 to America, 2·9 to Canada, 10·2 to France, and 2·9 per cent. to other countries.

The unprecedented high prices paid for sisal and its drought-resisting properties have encouraged many farmers to extend its cultivation. Owing to political conditions exports showed a falling off in 1917, but it is expected that the situation will show marked improvement in the near future. In 1917, 7,501,346 lb. of sisal was exported of a value of £181,695, compared with 8,369,245 lb., valued at £114,465, in 1916. Increased cultivation of sisal is reported from many of the islands, including Abaco (225 acres), Andros (400 acres), Biminis, Savannah Sound, James's Cistern, Long Island, Ragged Island (35 acres) and Watlings (100 acres). Sisal is largely used in the islands as a means of exchange.

The output of cane syrup at Abaco was 2,970 galls., valued at £487. Two sugar mills are in operation at Harbour Island which produced about 1,300 galls. of syrup in 1917.

Salt-making was formerly an important industry at Inagua and brought in considerable revenue to the Crown in the form of royalties; in one year three million bushels of salt was exported. It is thought desirable to attract the attention of capital and energy with a view to reopening the trade. There are also salt pans in other islands—Rum Cay, Long Cay, Long Island, Ragged Island and Exuma. —(*Col. Rep. Ann. No.* 978, *Feb.* 1919.)

FOREIGN.

Trade of Foochow (China) in 1918.—H.M. Consul in Foochow reports that lead, tin slabs and tinned plates were the only metallic substances of any value imported into Foochow in 1918, each showing a slight decrease compared with 1917. The total value was £103,000. There was a large increase in the quantity of sugar imported, from 65,028 piculs in 1917 to 110,847 piculs, valued at £182,750 (picul 133·33 lb.). Imports of kerosene oil increased from 1,322,260 galls. in 1917 to 2,026,746 galls., valued at £131,450, a figure still very much below the average. As usual, Japan supplied all the matches (£36,650) and coal (£30,500) obtained from abroad.

The mineral resources of the Province are believed to be considerable, but development has been retarded owing to the disturbed state of the interior. The molybdenum mines alone have been able to continue working, but the output was insignificant. Applications have been made for permission to work several new molybdenum mines, and work has been started on two lead mines, a copper, a coal and a zinc mine, but only by native companies which possess insufficient capital to provide adequate machinery. The iron deposits in the Anchi and Yungchun districts are believed to be very valuable, although no suitable coal is found in the neighbourhood. A Chinese company, with a nominal capital of 5,000,000 dollars, has been formed to work them.

Owing to the war, British trade has naturally lost the position it held five years ago, and Japan has taken full advantage of the opportunity offered, not only to replace British goods but enemy goods also. As it is unlikely that the cost of British goods will return to the old level, some of the trade may be regarded as permanently lost. It is on maintaining and improving the general superiority of their wares that British manufacturers will have to rely in future for the extension of their trade, rather than on any hope of competing in price with Japanese or native goods. The Japanese import trade is being very energetically handled. Local British firms are not prepared to grant the long credits required by the native retailer, the result being advantageous to the Japanese merchants who readily take the risk these credits involve.—(*B. of Trade J., July* 3, 1919.)

The Casein Industry in France.—For some time past France has been the largest producer of casein. The imports and exports during recent years have been as follows:—

	Imports in metric tons				Exports in metric tons			
—	Hard	Raw	Total	Value	Hard	Raw	Total	Value
				£				£
1913	14·5	25·2	39·7	4,431	502	7,706	8,208	378,983
1914	6·0	24·1	30·1	2,417	379	5,598	5,977	278,602
1916	40·1	5·6	45·7	11,731	140	3,936	4,076	309,434
1918	98·5	·5	99·0	33,210	188	1,470	1,658	222,008

The French production of casein not only supplies the home demand but furnishes a surplus for exportation. Recent exports to Germany have been: 1913, 3587 tons, and 1914, 1949 tons. Declared

exports to United States have been: 1915, 1,772,743 lb.; 1916, 2,150,762 lb.; 1917, 1,627,121 lb.; and 1918, 198,424 lb.—(*U.S. Com. Rep., May* 21, 1919.)

Demand for Chemicals in Greece.—Rapid developments in the textile industry have occasioned a great demand for bleaching powder; sodium nitrite and sulphonated castor oil for the production of Turkey red; potassium bichromate and considerable quantities of aniline oil and salts of aniline for making aniline black; sodium sulphide; and of ferrous sulphate for the reduction of indigo. Diamine dyes (Congo red etc.) and sulphur black are also in demand.—(*Z. angew. Chem., June* 17, 1919.)

Increase in the Price of Aniline Dyes in Germany.—Owing to the exceedingly difficult conditions under which chemical manufacture is carried on at present in Germany, the various firms connected with the Interessengemeinschaft have decided upon raising the prices of their chemical products. A still further rise is contemplated as being necessary owing to the stagnation of the dye industry and the mounting costs of raw materials and wages. These increased charges will have the effect of rendering more equal the prices charged for the products in the home and foreign markets. —(*Z. angew. Chem., July* 8, 1919.)

Effect of the Socialisation of the German Potash Industry.—For some years the large Dutch consumers have made payments in advance up to 10 million gulden to the Potash Syndicate for future deliveries. These credits are now withdrawn and will not be renewed by the Dutch consumers who state that they have no confidence in the solvency of a socialised syndicate.—(*Z. angew. Chem., June* 17, 1919.)

French and German Competition in the Potash Industry.—The provisional Potash Exchange at Mülhausen has offered to supply the Rotterdam dealers with 20,000 tons of kainite during 1919. The dealers, however, require a guarantee that the Exchange will supply them with the same quantity at a fixed price during 1920 and 1921, and should this condition not be accepted, they threaten to boycott French kainite and to turn to the German Potash Syndicate.—(*Z. angew. Zeit., July* 8, 1919.)

Quebracho Output for 1919.—The River Plate districts of Argentine and Paraguay form the chief source of the world's output of quebracho extract. The production for 1919 is estimated at about 170,000 tons, of which nearly 90 per cent. is credited to La Forestal Combination. The distribution of the extract is difficult to forecast, and will depend largely on the terms of peace, on freight rates, and the competing prices of chestnut extract.—(*U.S. Com. Rep., June* 7, 1919.)

Exports of Copra, Coconut Oil and Quinine from the Netherland East Indies.—The following figures give the exports from Java and Madura during the last three years, compared with those for 1913.

	Copra.	Quinine.	Coconut Oil.
	Metric tons.		Hectolitres.
1913	79,154	72	660
1916	38,492	114	108,680
1917	24,931	129	277,270
1918	3,493	251	277,770

The marked falling off in the exports of copra was due chiefly to the erection of local factories for extracting the coconut oil from the copra, the decrease taking place in exports to the Netherlands. The large increase in the exports of quinine is attributed to the growing demands of Great Britain and India, the United States and Japan.—(*Bd. of Trade J., July* 3, 1919.)

Economic Possibilities of East Africa.—The possibilities of agricultural development in the province of Mozambique are practically unlimited, as not only tropical but many sub-tropical and temperate crops can be grown. The chief products are sugar, cotton, coconuts, maize, beans and various oilseeds. Sugar cultivation is entirely in the hands of large land-holding companies, some 250,000 acres being under cultivation; the prospects are very hopeful and there is still much scope for future development. The cultivation of cotton is also making progress; it is grown in the Zambesi district by natives under the supervision of the Mozambique Company. The production of copra and sisal is increasing, cattle raising is being established on scientific lines, and there are cold-storage plants at Port Matola. The exploitation of the large forests of timber, mostly hardwood, is hindered by lack of good transport. The chief kinds of wood are cedar and "mucrusse"; the latter is similar to teak and has proved very suitable for railway sleepers, being unattacked by white ants.

Manufacturing industries are only in their infancy; soap, oil, and oilcake are being made, also bricks, tiles, and pottery. Plans are under consideration for starting a tanning industry and for the manufacture of cement, paper, glass, iron and steel. The future development of the province depends largely on transport facilities, and the Government has a project in hand for extending the railways. Lorenzo Marques is rapidly becoming an important port and coaling station. An excellent harbour costing upwards of £500,000 has been built and a large up-to-date coaling plant installed.—(*U.S. Com. Rep., May* 27, 1919.)

COMPANY NEWS.

MOND NICKEL CO., LTD.

Mr. Robert Mond, presiding at the annual general meeting on July 24, gave an account of some of the company's activities during the war period. The Board had placed the whole of the output at the disposal of the Government, and this had been doubled between 1914 and 1917. But for the difficulties met with, the plant for trebling the pre-war output would have been completed. The production of copper-sulphate had been doubled, and a new spraying mixture "Blighty" had been put on the market. The comparatively low prices obtained for the nickel sold to the Government had been offset by the much higher prices at which copper sulphate had been sold in the export markets. The platinum and palladium from the residues of the refining process had helped to supply the enormous war demand for these precious metals. With regard to costs of production, those of mining and treatment in Canada had nearly doubled, the cost of coal had more than doubled, and that of sulphuric acid had increased by 170 per cent.; timber had risen 400 per cent., steel work 180 per cent., bags 190 per cent., and casks 170 per cent. The wages of the process men in South Wales had risen by about 200 per cent., of men on shift work 187 per cent., and of day labourers 142 per cent.

Including the sum of £118,251 brought forward, the amount to the credit of profit and loss for the year ending April 30, 1919, is £422,679 (capital £3,400,000, debentures and interest accrued £899,375). The total distribution on the 7 per cent. preference shares and on the ordinary shares (17½ per cent. free of tax) amounts to £254,600, leaving £168,058 to be carried forward. Stocks on hand, valued at £2,200,741, show a large increase, owing to cessation of the

war demand for nickel, and this, together with the fact that the British and Allied Governments have also accumulated large stocks, has necessitated a temporary reduction of output, both in this country and in Canada.

ELECTRO BLEACH AND BY-PRODUCTS, LTD.

The gross profit for the year 1918, after deducting cost of repairs and standing charges, was £60,750, and the net profit £24,498 (issued capital £180,000). Of the latter sum, debenture interest and sinking fund call for £7,874, £4,000 goes to reserve, 7 per cent. and 12½ per cent. dividends are paid on the preference and ordinary shares respectively, leaving £394 to be carried forward, as against £1,670 brought in. During the year £70,468 was spent on additions to plant, and a loan of £35,890 was contracted from the Ministry of Munitions. The Inland Revenue Department has allowed the appropriation from revenue of £10,000 for deferred repairs

PACIFIC PHOSPHATE CO., LTD.

Owing to lack of tonnage and the prohibition of shipments of phosphate from Ocean Island and Nauru to neutral countries, the company's business has been seriously dislocated during the war. The Island of Nauru, which contains the largest phosphate deposit in the Pacific Ocean, is no longer a German possession, having passed under British control. Shipments to Europe have not been possible during the past year, and trade to the Dominions and the Far East has been very restricted; hence the profit has been smaller than in 1917. Half of the sum of £50,000 placed to a "War Contingency Reserve" has been restored to the profit and loss account, and this sum, together with £20,460 brought forward and the net profit for the year of £44,882 (issued capital, £787,500), allows of a dividend for the year of 10 per cent. on the ordinary shares, leaving £13,830 to be carried forward.

BRIMSDOWN LEAD CO., LTD.

Many difficulties were encountered during 1918 owing to circumstances arising out of the war, but since the conclusion of hostilities, the output of white lead and other lead products has materially increased, and at the present time the demand is very great. After allocating £4620 to depreciation, there is a net profit of £5598 which compares with £6118 in 1917 (issued capital £130,925).

The directors have put forward a scheme of reconstruction which should place the company on a dividend-paying basis in the near future. The preference shareholders are asked to take one 7 per cent. non-cumulative preference share of 10*s.* and two ordinary shares of 5*s.* each in exchange for one existing 7 per cent. cumulative preference share of 15*s.* It is anticipated that the proposals will be adopted, a large majority of preference shareholders having signified its assent.

W. J. BUSH AND CO., LTD.

The 22nd annual general meeting was held in London on July 17. Mr. J. M. Bush, who presided, said that the recent increase in the spirit duty up to a total of 51*s.* 6*d.* per proof gallon will put essence manufacturers in this country in a most disadvantageous position as compared with their foreign competitors. As soon as freight facilities are restored British manufacturers are almost certain to find that much of their export trade is lost, and the high prices are also likely to cause a smaller demand in the home market. Especially will this be the case in essences in which ethyl compounds are used, which have to be made with duty-paid spirits and on which no drawback is allowed. For example, ethyl acetate and ethyl butyrate sell in the United States at one-eighth the price they cost to manufacture in this country at the present rate of duty. Obviously, the remedy is to pay drawback on these compounds, and it is difficult to see the point of view of the Government in refusing so reasonable a request. This situation has been pointed out to the Government by the British Essence Manufacturers' Association, and the suggestion put forward that some differentiation of duty should be made between spirit used for potable purposes and that used in other food industries. These representations, however, have so far been in vain. The whole of the company's investments in Russia have been written off without drawing on the reserve fund or reducing dividends. All other foreign branches and subsidiary companies have done well. The gross profit for 1918 is £271,278, and the net profit £65,903 (capital £250,000). The available balance amounts to £90,258, of which £20,000 is put to reserve and £10,000 applied to writing down goodwill. The dividend on the ordinary shares is 20 per cent. for the year.

EVANS, SON, LESCHER, & WEBB, LTD.

At an extraordinary general meeting held in Liverpool on July 16, it was unanimously resolved to increase the capital of the company to £750,000, by the issue of an additional £150,000 in ordinary shares. The chairman, Mr. W. P. Evans, said the new capital was required to increase manufacture and to develop the business at home and abroad. Increased capital was also required in view of the enhanced value of the company's products. Trade had been developing satisfactorily of late, and for the first four months of the current year sales showed an increase of 20 per cent. in value over the corresponding period last year. The new shares will be issued in the autumn.

FORTUNA NITRATE.

Speaking at the annual general meeting held on July 7, the chairman, Mr. H. C. Gibbs, said that two of the company's three oficinas were closed down, but at the third a new process for the treatment of low grade material was being tested. This process would undoubtedly lead to reduction in costs, and during May the experimental plant had produced 45,000 quintals at a cost of 8*s.* 7*d.* per quintal f.o.b. The net earnings for 1918 amounted to £36,406, or 23¼ per cent. on the issued capital (£154,000), but in view of the adverse situation only 7½ per cent. had been declared, leaving £32,065 to be carried forward. In 1917 there was a loss of £9928 and no dividend was paid. The production of nitrate in 1918 amounted to 1,207,788 quintals, of which about 415,000 remained unsold; total stocks in Chile awaiting shipment amount to about 1,500,000 tons. The quantity of exploitable nitrate, above 12 per cent. grade, in the company's grounds was estimated at 9,500,000 quintals on December 31 last. In addition there is much material of lower grade, which, it is hoped, but not proved, may be worked at a profit by the new process.

ALIANZA NITRATE.

The report for the year ended December 1918 shows a satisfactory financial position. The trading profit was £467,213 and the output 2,010,798 quintals, equivalent to a profit of about 4*s.* 7*d.* per quintal, compared with 2*s.* 7*d.* in the previous year. The net profit was £363,961. The dividend was maintained at 40 per cent. free of tax, and the carry-forward is more than doubled at £299,889 (capital £500,000). There is a surplus of cash assets over liabilities of £422,755, as against £207,458 a year ago. Unsold stock amounts to 292,943 quintals, and production is being restricted.

SANTA RITA NITRATE.

The gross trading profit, including interest, amounted to £12,881 in 1918, and the net profit £8970, which with £1231 brought in allows of a dividend of 5 per cent., leaving £5201 to be carried forward. The oficina is closed down and manufacture will be suspended until the large stocks in the country have been materially reduced. Extraction of raw material is being continued.

New Capital Issues.—*Oilfields of England, Ltd.* invites subscriptions for 170,000 ordinary shares of £1 each at par. The authorised capital is £250,000 and the main object of the company is to acquire petroleum rights over oil-bearing lands in England, and to bore for and produce oil on a commercial scale. A licence has been obtained from the Government to bore on the Kelham Estate, Nottinghamshire, where, it is stated, oil has been struck at a depth of 2440 ft. The sinking of wells is now to be undertaken, the site of the first three of which has been sanctioned by the Government.

Van den Berghs, Ltd. invites offers for 1,000,000 seven per cent. " C " cumulative preference shares of £1 each at 21*s.* per share, thereby increasing the capital to £3,675,000. The new shares will rank in front of the £625,000 ordinary shares which have received an average dividend of 22 per cent. during the past five years.

British Window Glass Co., Ltd. has been formed with a capital of £450,000 to acquire certain secret processes and inventions of M. E. Fourcault, of Charleroi, Belgium, to erect works at Queenborough, Kent, and to manufacture window glass. The share capital is divided into £400,000 eight per cent. cumulative participating preference shares of £1, and 1,000,000 ordinary shares of 1*s.* each. The preference shares were offered for subscription at par, and the issue was largely oversubscribed.

Borax Consolidated, Ltd.—The capital of this company has been increased from £2,300,000 to £2,900,000, by the creation of 600,000 new deferred ordinary shares of £1 each, of which 250,000 are now offered at 37*s.* 6*d.* per share. The net profit for 1918 was £423,971 after payment of excess profits duty, and the dividend on the deferred ordinary shares was 15 per cent.

United Glass Bottle Manufacturers, Ltd.—This company has made an issue of 100,000 £1 ordinary shares at 21*s.* and £75,000 first mortgage debenture stock at 95 per cent.

Amalgamations, etc.—The Manbre Saccharine Co., Ltd., and the Sugar and Malt Products, Ltd., have agreed to amalgamate and to establish a new company, to be called " Manbre Sugar and Malt, Ltd.," with a capital of £400,000, to take over the assets and business of both.

The directors of the Associated Portland Cement Manufacturers (1900), Ltd., and of the British Portland Cement Manufacturers have agreed to the establishment of a scheme of joint management for the two companies which will permit of substantial economies being effected.

The four English oil companies operating at Baku, Russia—the Baku Russian Petroleum (1909), Bibi Eibat Oil Co., European Oilfields Corporation, and the Russian Petroleum Co.—have united their interests and formed a new company, the Baku Consolidated Oilfields, Ltd., to acquire and exploit oilfields in Baku and elsewhere.

An amalgamation has been effected between British Coalite, Ltd., Coalite, Ltd., and Low Temperature Carbonisation, Ltd.; the new company will bear the title of the last-named, which will acquire a controlling interest in the Barnsley Smokeless Fuel Co. The new capital will be £1,200,000.

REVIEWS.

Applied Optics. The Computation of Optical Systems, being the " Handbuch der angewandten Optik " of A. Steinheil and E. Voit. *Translated and edited by* J. W. French. *In two volumes. Vol.* 1, *pp. xiii* + 170. *Vol.* 2, *pp.* 207. (*London, Glasgow and Bombay: Blackie and Son, Ltd.* 1918 *and* 1919 *respectively.*) *Price* 12*s.* 6*d. net each volume*

The history of applied optics in Britain is the exact parallel of the more familiar history of the dye industry in this country. The growth of optical science here may have been hindered by Newton's espousal of the corpuscular theory of light, and his failure to realise an achromatic refracting system. Be that as it may, the foundations of applied optics were well and truly laid by Sir George Airy in papers appearing in the Transactions of the Cambridge Philosophical Society for 1827, some 30 years before the appearance of the work of von Seidel, to whose well-known conditions all well-designed optical systems must conform. Airy's results were extended and simplified by Coddington in his book, " A Treatise on the Reflection and Refraction of Light," appearing in 1829. The contributions of Herschel are enshrined in the Encyclopædia Metropolitana along with many other treasures which have there been buried and forgotten. The successful production by Schott and Abbe, subsequently to 1881, of varieties of optical glass followed upon their extension of the pioneering work of Vernon Harcourt and Stokes carried out during the first half of the nineteenth century. Czapski was of the opinion that success would have crowned the efforts of the English investigators if they had had at their disposal the services of a sympathetic glass maker. It is not without interest to note, as Cheshire has recently pointed out, that in 1881, Zeiss was entirely dependent upon Chance Bros. of Birmingham and Feil of Paris for his supplies of optical glass. Dollond was the first to achieve the construction of an achromatic combination of lenses. In 1886 the first catalogue of Jena glasses appeared, and thereafter the optical trade passed more and more into the hands of Germany. The optical fortune bequeathed us has not been utilised to our advantage, and belated attempts are now being made to recover our goodly heritage.

The book under review embodies the trigonometrical method developed by von Seidel for the rigid computation of optical systems. The formulæ have been employed for this purpose in the workshops of C. A. Steinheil and Sons for at least 30 years. The presentation of optical theory is condensed and does not conform with the traditional teaching of most English text-books—where the subject is developed algebraically. The algebraic method is well expounded in Dennis Taylor's " System of Applied Optics," 1906, and a cursory examination of the formulæ developed in the two modes of presentation leaves the reviewer undecided as to which system facilitates computation the more. Efficiency in the application of the trigonometrical method can only be achieved by bringing the teaching of optics in our schools and colleges into line with that method. Otherwise optical firms would be well advised to develop the algebraic method.

The work appears to be a translation of the original treatise of 1890. Some 12 pages of Vol. 1 are devoted to the discussion of symbols and sign convention. The recent paper shortage is not reflected in the fact that this discussion is repeated verbatim in Vol. 2 together with considerable other matter from Vol. 1. No attempt has been made to bring the signs and symbols employed into con-

formity with English practice. Thus (Vol. 1, p. 10) "x is measured upwards and the value of y is measured towards the side." Again (Vol. 1, p. 11) π denotes "the angle which etc." and is not used to represent the constant 3·141 . . . . The meaning of succeeding sentences (Vol. 1, p. 12) "A radius vector is always positive. Radii of curvature may be positive or negative" is a little obscure. The sign convention enables one to write apparently (Vol. 2, p. 27) $\frac{1}{f}=\frac{1}{v}-\frac{1}{u}$ or $\frac{1}{f}=\frac{1}{u}-\frac{1}{v}$, indifferently.

Any advantage accruing from the use of coloured optical diagrams is largely discounted by the fact that "it has not been found practicable to make the colours in all cases correspond with the colours of particular rays of light." There is no apparent need for a coloured illustration of a spectroscope of fairly old German design. The chapter on the determination of refractive indexes suffers from the defect inherent to a translation of a fairly old work—it is not up to date. Mercury and even cadmium lamps are now commonly employed as sources of spectroscope illumination in optical works. Such adverse criticisms as have been advanced do not detract from the value of the main purpose of the work—to facilitate optical computation. This purpose the work will undoubtedly fulfil for some time. In the meantime there is still place for a native work dealing with the current practice of optical measurement, and in addition the trigonometrical computation of optical systems —if the algebraic method has been tried and found wanting. J. S. G. Thomas.

The Metals of the Rare Earths. *By* J. F. Spencer. *Monographs on Inorganic and Physical Chemistry. With diagrams. Pp. x + 279. (London: Longmans, Green and Co. 1919.) Price 12s. 6d. net.*

The book commences with an interesting historical summary of the discovery of the various members of the rare earths, which is followed by an account of their occurrence in nature. Chapter III gives a useful general account of the various methods which are employed for separating the rare earths, whilst the methods of controlling the separations are described in the succeeding chapter. Three long chapters deal with the preparation and properties of the compounds formed by members of the cerium group of earths, by members of the ythium group and by thorium, and these chapters contain various physical data, so far as they are available, of the metals and compounds. Atomic weight determinations, the position of the rare earth elements in the Periodic System and uses of the rare earths are dealt with in other chapters. The consideration of thorium along with the rare earths in the narrower sense is eminently justifiable and expedient. The whole treatment of the subject is logical and thorough and the book gives a very readable account of a difficult branch of inorganic chemistry. It can be strongly recommended to all interested in the rare earths. Reference, name and subject indexes, which seem to have been carefully compiled, greatly add to the value of the book.

The various compounds of the rare earth metals which have been singled out for detailed description have been selected judiciously, though it would have been interesting if some information had been given as to the reliance that can be placed on the formulæ attributed to many of the compounds.

The book is practically free from errors, though on page 83 it is wrongly stated that the pentahydrate of cerous sulphate is stable in contact with solutions between 56° and 100·5°, whereas the solubility data given and the diagram both show that it is unstable with respect to the tetrahydrate over the whole of this range of temperature. This error is however to be attributed to a misleading statement made on the diagram which has been borrowed from another book. The proof reading has been very carefully done and the only misprint of any consequence which has been noticed is on page 138, line 9 from bottom, where gadolinium should be substituted for terbium.

Like other volumes of the series the book is well printed. H. Bassett.

PUBLICATIONS RECEIVED.

Volumetric Analysis. *For Students of Pharmaceutical and General Chemistry. By* C. H. Hampshire. *Second Edition. Pp. 127. (London: J. and A. Churchill. 1919.) Price 5s.*

Rapport sur le Commerce et l'Industrie de la Suisse en 1917. *Pp. 476. (Zürich: L'Union du Commerce et de l'Industrie.)*

Etude de l'Organisation de la Production Française apres la Guerre. Métallurgie. Constructions Mécaniques et Métalliques. *La Sidérurgie: Produits ordinaires. By* M. G. Carlioz. *Pp. 112. (Paris: Revue de Métallurgie. December 1917.) La Sidérurgie: Produits de la Métallurgie du Fer. By* M. G. Charpy. *Pp. 42. (Paris: Revue de Métallurgie. March 1918.)*

Mémoire sur le Traitement Thermique des Obus *(Application de la méthode Taylor). By* L. Guillet. *Pp. 154. (Paris: Revue de Métallurgie. January 1916.)*

Bulletin of the Rubber Growers' Association (Incorporated). *Vol. 1. No. 1. July 1919. Pp. 55. (Registered Office: 38, Eastcheap, London, E.C. 3.)*

Annual Report on the Mineral Production of Canada during the Calendar Year 1917. *(Department of Mines, Canada.) Pp. 258. (Ottawa: J. de Labroquerie Taché. 1919.)*

Publications of the United States Bureau of Mines. Department of the Interior. *(Washington: Government Printing Office. 1918.)*

Mining and Milling of Lead and Zinc Ores in the Missouri-Kansas-Oklahoma Zinc District. *By* C. A. Wright. *Bulletin 154. Pp. 134.*

Extinguishing and Preventing Oil and Gas Fires. *By* C. P. Bowie. *Bulletin 170. Pp. 50.*

Methods of Shutting off Water in Oil and Gas Wells. *By* F. B. Tough. *Bulletin 163. Pp. 122.*

Innovations in the Metallurgy of Lead. *By* D. A. Lyon *and* O. R. Ralston. *Bulletin 157. Pp. 176.*

Notes on the Black Sand Deposits of Southern Oregon and Northern California. *By* R. R. Hornor.

Central Station Heating (Its Economic Features with Reference to Community Service). *By* J. C. White. *Technical Paper 191.*

Eighth Annual Report by the Director of the Bureau of Mines to the Secretary of the Interior for the Fiscal Year ended June 30, 1918. *Pp. 124.*

Publications of the United States Geological Survey. Department of the Interior. *(Washington: Government Printing Office. 1919.)*

Sand-Lime Brick in 1918. *By* J. Middleton.

Gems and Precious Stones in 1918. *By* W. T. Schaller.

SOME CHEMICAL PLANTS IN THE COLOGNE AREA.

Part II.

BY A. J. ALLMAND AND E. R. WILLIAMS.

Elektrometallurgische Werke, Horrem.

This factory is situated a few miles west of Cologne in the " braunkohle " district and adjoining the large " Fortuna " generating station, from which it draws its power. It manufactures aluminium and zinc, using about 8500—9500 k.w. for the former and 2500 k.w. for the latter when working at full pressure. This includes expenditure on lighting and mechanical power. A total of up to 350 workpeople can be employed. The manufacture of zinc commenced in September 1913, and the production of aluminium has been taken up since the beginning of the war.

Aluminium Plant.

Three-phase 25,000-volt current from Fortuna was stepped down in a rotary converter station to 200-volt direct current. This was led to the furnace room, containing 78 cells in three parallel rows of 26 each. These cells were of steel plate, reinforced by channel irons outside and along the bottom and about 8 ft. × 4½ ft. × 2½ ft. deep. A casting through the base made contact between the carbon lining and the cathode electrical contact. The lining consisted of a mixture of fine coke and pitch, rammed into the steel shell, the whole being subsequently baked in oil-fired brick ovens. The dimensions of the furnace inside the lining were about 6 ft. × 3 ft. and 6 in. deep at the sides. The bottom of the lining sloped towards the centre, forming a well where the molten aluminium collected. A cast-iron form was used when lining the cell to ensure its right dimensions.

Above the furnace ran two copper bus-bars, supported on wooden posts and each carrying four anodes. The latter were about 2 ft. long and 1 ft. × 1 ft. in cross-section, and were furnished at the top with a cast-iron plug. A flat copper bar bolted into this made connexion with the bus-bar, and a thumb-screwed clamp permitted easy lateral or vertical adjustment. The bath appeared to be of normal composition, and was worked in the usual way, the solidified crust on the top being occasionally broken and the hot alumina resting on it pushed down and stirred in. Every 24 hours, one of the anodes in the centre was removed and the metal which had collected in the crucible ladled out by an iron spoon and cast in iron moulds. It was subsequently remelted to free it from inclusions of the bath.

The current per cell is 14,000—16,000 ampères—normally 14,500. The voltage, read by separate meters on each cell, varies between 6·5 and 7·5 volts. Each furnace therefore absorbs 100—110 k.w. The production of metal was stated to be 70—90 kilo. per furnace per 24 hours. An output of 80 kilo. (using 14,500 amps. and 7 volts) corresponds to 30·5 k.w.-hrs. per kilo. of metal and to a current efficiency of 68 per cent. The average efficiency may, however, well exceed this figure, as it was stated that 1200 tons of metal had been produced during the last six months of 1918, corresponding to at least 84 kilo. per furnace day.

The anodes, obtained from Rauxel (Westphalia), Plania (Ratibor, Silesia), Conrady (Nürnberg) and Siemens (Berlin-Lichtenberg) burnt very evenly and squarely at the ends. On an average they lasted two days, and if of good quality four to five days. If of bad quality they cracked and fell to pieces in an hour or two. The cell lining had a somewhat indefinite life, but normally did not need renewal more than once a year.

Zinc Plant.

In this plant zinc is obtained electro-thermally from a crude zinc oxide by reduction with coke. The ore used comes from the Harz, Ludwigshafen, etc., and contains about 70 per cent. zinc with small quantities of lead, copper, silver, antimony and cadmium. It is first mixed, slightly damp, with finely divided coke, and preheated to a dull red heat in a revolving roasting furnace (Bruchner type) by means of an oil and tar jet burner. This operation was said to take 8—10 hours. The charge, weighing about 5—5½ tons, and consisting of 70 per cent. ore and 30 per cent. coke, is then transferred to the electric furnace, hot from a previous operation, and smelted, this process taking anything from 24—36 hours. The zinc distils off, and is for the most part condensed and tapped as liquid, the remainder being burnt to zinc white.

The electric furnaces consisted of steel cylinders, 15 ft. in length and 15 ft. in diameter, mounted on trunnions, and rotated on a horizontal axis by means of a gear and pinion. The shell was lined throughout by 18 in. of refractory chamotte material. Three charging doors were disposed symmetrically round the middle of the casing. Through each end of the latter passed four sets of electrodes, and copper rings and brushes made it possible to supply current in all positions of the furnace. The electrodes were of amorphous carbon rod about 5 in. in diameter and 3 ft. long. From statements made, it would appear that they simply carry current to the charge, which is sufficiently conducting to allow the heating currents to pass through it (high proportion of coke, preheating).

Three-phase current is employed, and with a current of 2000—3000 amps., a voltage of 160—170 volts and a power factor of 0·8, each furnace consumes about 500—600 k.w. The exact figures, as also the time taken for the complete process, depend very much on the nature of the ore, skill of the workmen, etc.

The condenser, which abutted directly on to the furnace, consisted of a brick-lined cylinder, also capable of rotation on a horizontal axis. The end of the furnace was pierced by three holes about 8 in. in diameter, placed symmetrically about 18 in. from the axis of the cylinder. To these corresponded three holes in the condenser, and the zinc vapours passed directly through and for the most part condensed to liquid. Uncondensed vapours were burnt at the open end of the condenser, and passed into a stack, along a series of cooling flues and so to bag filters, connected with a suction fan. The metallic zinc was tapped off every 5—6 hours, and run into iron moulds.

The total zinc recovery, as stated to us, was low—only 75—77 per cent. Of this a certain amount is collected as zinc white (80 per cent. zinc), each charge giving about 150 kilo. of this product. The metal itself is 98 per cent. pure, the chief impurity being lead. The slags from a single operation weigh at least 1600—1700 kilo., and consist very largely of coke. At no time are they molten.

The plant when seen contained two preheaters and five electric furnaces. Four of the latter are constantly in action when working under full pressure, under which conditions a total of 300 tons of coke (for all purposes) and 10 tons of electrodes were stated to be required per month. Three hundred tons of zinc was made during the last

half of 1918. Practically no work was done in November and December.

A.G. FÜR STICKSTOFFDÜNGER, KNAPSACK.

This factory, which commenced work in 1906, adjoins the "braunkohle" deposits, a few miles S.W. of Cologne. It generates its own power, and makes calcium carbide and cyanamide. For a time during the war, ammonia was manufactured and sent to Leverkusen (see Part I), but this was discontinued later. The number of hands normally employed before the war was 2000.

Calcium Carbide.

The power plant consists of one turbo-generator of 4500 k.w., two of 5000 k.w., and five of 11,250 k.w. The last named generate three-phase current at 6000 volts, stepped down to 160 volts for the furnaces. One of these machines is kept as a stand-by when working at full pressure. There are seven furnaces of full capacity, 5000—6000 k.w., which can produce 200 tons of carbide per 24 hours. When visited two of the large generators were in use, giving 22,000 k.w. Of this quantity, 3000 k.w. was consumed for lighting and mechanical power. The balance of 19,000 k.w. was feeding four furnaces, which were turning out about 100 tons of carbide in the 24 hours.

The carbide furnaces consisted of steel plate shells about 30 ft. × 14 ft. × 10 ft. deep, and were lined with 18 in. of firebrick. It was stated that a carbon concrete crucible was rammed in on top of this lining up to the tap-holes. This would correspond to a minimum thickness of about 2 ft. There were three tap-holes, one under each electrode, with openings in the shell of about 2 ft. 6 in. by 4 ft.

The electrodes, which were in line and about 8 ft. apart from centre to centre, were of amorphous carbon (Siemens, Berlin-Lichtenberg, and a local factory), and built up of two sections 20 × 20 in. with one section 20 × 10 in. between them, giving a total cross-section of 50 × 20 in. Their length was 7 ft. 6 in. to 8 ft. There was no covering of any kind to prevent oxidation. The U-shaped water-cooled boss of the electrode head was recessed about 10 in. into the carbons, which were supported by bolts passing through the carbon shoulders into this boss. The latter extended over the whole of the top of the electrodes in the shape of an 8 in.-thick water-cooled flange. Flange, boss, and the actual electrical contact head were water-cooled by separate systems, employing flexible metal hose. Groups of flexible copper cables carried the power to the electrodes, which were suspended by chains passing over large sheaves down to the hoists set on the charging floor 30 ft. from the furnace. The hoists were worm-geared and engaged with a common non-reversing motor-shaft by hand levers and friction-clutch bevel-gears, thus allowing independent or simultaneous adjustment of the electrodes by a single motor. A meter board was set in front of the hoists. There was no simple means provided of lateral adjustment of the electrodes, though suspensions and power and water connexions would have permitted it. Electrodes were changed on the charging floor, 45—60 minutes being required.

Four openings in the back wall of the furnace were connected to a main exhauster flue, and by the use of curtain walls and an artificial draught, dust and smoke were reduced to a minimum. The charge consisted of lime and a very hard gas coke in approximately equal proportions. The lime passed through a 4 in. ring. It appeared to contain much small material. The daily requirements were stated to be 260 tons working at full pressure. The coke varied from 1 to 3 in. in diameter. Maximum daily requirements were said to be 185 tons. Lime and anthracite were present on the charging floor, to correct the grade of the carbide or the operation of the furnace.

Under normal operating conditions, the charge seemed to be 3—4 ft. below the feed floor, with the electrodes immersed to a depth of about 1 ft. No attempt was made to close in the top and the furnaces appeared to be in a perpetual state of "boiling down." It was said that there were no difficulties due to "bottoms building up," which seems very probable. The furnaces appeared to run with "flat tops." Wooden pokers were used for loosening the charge.

Electrodes were red-hot half-way up after service for a few hours. Half-consumed electrodes were red-hot up to the head. Nevertheless the different carbons of the built-up electrode burnt away very evenly. The electrode consumption was given as five kilo. per ton of carbide, a somewhat high figure. The power factor was given as 0·85—0·9. With a furnace power consumption of 5000 k.w. at 160 volts, this works out at a current of about 20,000 amps. per phase and an electrode current density of 20 amps. per sq. in.

The furnace was completely tapped every $2\frac{1}{4}$ hours, *i.e.* one tap-hole every 45 minutes. An ordinary type of arc tapper, fitted with a 4 ft. × 4 in. × 4 in. amorphous carbon electrode, was suspended before each tap-hole. The carbide flowed into semi-cylindrical cast-iron chills over an air-cooled lip of cast iron, protected by a coating of solid carbide. It was stated that 1 kilo. produced 270 litres of acetylene. If this were an N.T.P. figure, it would correspond to a 77 per cent. carbide.

Cyanamide.

The carbide from the furnaces was cooled, crushed in jaw crushers, ground in tubular bar mills and conveyed to the nitrification plant. The nitrogen was furnished by a Linde liquid air installation.

The ovens consisted of horizontal cast-iron cylinders about 150 × 6 ft., enclosed for half their length in a brick setting. A track throughout the length of the ovens was used for the passage of the loaded cars of carbide. Gas, air and nitrogen ports were provided in the lower portion of the ovens at the end in the brick setting. The ends of the cylinders were closed by gas-tight cast-iron doors.

Carbide was placed in loosely made sheet-iron boxes 30 × 20 × 13 in., lined with newspaper. Fourteen boxes were piled on each truck and the loaded trucks were pushed into the ovens by means of a mechanical pusher. Twenty-eight such trucks were put into each oven. The oven being filled, the doors were closed and gas flames started. When the carbide had reached a sufficiently high temperature the gas supply was cut off and the nitrogen admitted. Absorption takes place immediately and the temperature of the carbide rises very rapidly. The complete cycle of heating and nitrifying occupies 28 hours. The nitrogen mains were not arranged for the series flow of gas.

When nitrification was completed the ovens were opened and the finished trucks were pushed out on to cooling tracks as the fresh charges of carbide were pushed into the oven. The blocks of hard crude "lime nitrogen" after cooling were broken, crushed and ground. The nitrogen content was said to average 20 per cent. The method of preliminary heating caused a loss of carbide due to oxidation, but the coating of lime resulting was removed before crushing and finishing the cyanamide.

IN commenting on the dearth of nitrogenous fertilisers in Germany, Prof. Neubauer estimates the present requirements at 360,000 metric tons of combined nitrogen per annum. About 100,000 tons yearly was available during the war.

INDIAN CHEMICAL INDUSTRIES.*

Coal is available as a source of power for the manufacture of fundamental heavy chemicals in North, but not in South, India. In the latter locality wood is cheap, and the production of charcoal as a fuel of high calorific power is under consideration in Mysore. Electric energy, dependent on water power, is intermittent owing to climatic conditions. The manufacture of chemical plant and machinery, previously imported, has been undertaken during the war. The most promising line of development seems to be the cultivation of raw materials and the manufacture from them of finished products, as well as the working up of various ores and mineral substances. The question of tariffs is, however, important.

Mineral Acids.—In default of iron pyrites, an expensive, high-grade sulphuric acid is made from Sicilian or Japanese sulphur, but a cheaper acid is likely to be manufactured from sulphur dioxide obtained in the roasting of Burmese zinc concentrates. Progress in sulphuric acid manufacture is shown by the rapid diminution in the amount of imported acid, which stood at 3196 tons, worth £36,664, in 1913—14, and at 21 tons, worth £978, in 1917—18, whilst the amount of imported sulphur steadily rose during the same period from 6327 tons, worth £39,894, to 9785 tons, worth £111,790.

The manufacture of nitric acid now meets local requirements, and is capable of extension; the imports are consequently small. Chilean nitrate is preferred to the Indian salt, although in the latter case the by-product after neutralisation with lime might be used as a potash fertiliser. The manufacture of synthetic nitric acid has not yet been considered.

Hydrochloric acid tends to rise in price (Rs.300 per ton in 1914) as there is little market for the by-product sodium sulphate, the Leblanc soda process not being used. The present annual output is 600 tons, and little is imported.

Alkalis.—Owing to lack of refrigerating plants, ammonia is not largely used in India. Ammonium salts find various technical applications; the supply of sulphate, however, exceeds requirements, and none is now imported.

The manufacture of sodium carbonate and caustic soda is not carried out in India, but crude sodium carbonate is found in the United Provinces and Mysore, in Sind, and especially Khairpur State, where 3600 tons was procured in 1915—16.

Recent imports are shown in the following table :—

	Sodium carbonate		Caustic soda	
Year	Quantity Tons	Value £	Quantity Tons	Value £
1912–13 ...	13,856	74,574	4942	53,534
1913–14 ...	21,157	106,172	4910	58,379
1914–15 ...	22,628	116,423	5905	70,311
1915–16 ...	27,639	157,117	4395	64,845
1916–17 ...	18,376	129,740	2855	79,128
1917–18 ...	35,014	288,194	5855	222,861

Common Salt.—Recent imports of high-grade salt have been as follows: 1914—15, 465,694 tons, worth £493,569; 1915—16, 548,940 tons, worth £1,264,054; 1916—17, 445,426 tons, worth £1,276,375; 1917—18, 336,985 tons, worth £1,467,193. (See also this J., 1919, 63R.)

* By Prof. J. J. Sudborough and Dr. J. L. Simonsen, abstracted from the Industrial Handbook of the Indian Munitions Board, 1919.

Coal Tar Products.—The amounts of tar available in India at present are insufficient for the establishment of a large coal tar industry, and the only way in which such an industry could be established would be to coke at the pit-head all suitable coal and send the tar to a central refinery. At present 520,000 tons of coke is produced per annum, yielding about 8000 tons of tar.

Imports of dyes and drugs.

	Dyes		Drugs
Year	Quantity Tons	Value £	Value £
1912–13 ...	8173	765,404	275,590
1913–14 ...	7252	706,731	301,738
1914–15 ...	3554	317,500	267,691
1915–16 ...	320	113,903	330,220
1916–17 ...	480	436,118	414,643
1917–18 ...	954	652,050	320,438

Essential Oils.—The following essential oils are obtained from raw materials grown in India and Ceylon: Anise, cardamom, cinnamon, cinnamon leaf, coriander, East Indian dill, ginger, sandalwood, thymol, vetivert, lemongrass, palmarosa, gingergrass, citronella. Cardamom, sandalwood, thymol and palmarosa oils are obtained from products grown only in India and Ceylon.

Since 1914 various developments have taken place in the distillation of essential oils. Sandalwood is now distilled instead of being sold by auction; thymol crystals are produced from ajwan seed; citronella oil is being distilled in Burma; palmarosa oil is steam distilled. The refining of oils and perfumes calls for scientific treatment. The following amounts of raw materials for essential oils were exported in 1917—18: Ajwan seed, 3960 cwt., worth £2735; aniseed, 1573 cwt., worth £1065; cardamoms, 716,358 lbs., worth £64,740; cinnamon, 55,554 lbs., worth £1064; coriander seed, 116,273 cwt., worth £80,154; cummin seed, 18,439 cwt., worth £54,778; cummin seed, black, 3379 cwt., worth £5030; dill or sawn seed, 33,813 cwt., worth £28,781; ginger, 5,841,374 lbs., worth £87,254; sandalwood, worth £56,644; lemongrass oil, 26,871 galls., worth £25,613.

Vegetable Oils.—The chief oil seeds produced in India are: Linseed, cottonseed, coconut, rape, groundnut (this J., 1918, 384R), castor, sesamum, and mahua.

Exports of the different products during 1917—18 were: Linseed, 140,676 tons, worth £1,716,552; linseed oil, 557,663 gallons, worth £127,178; cottonseed, 1,627 tons, worth £9,056; cottonseed oil, 76,444 gallons, worth £9,621; cottonseed cake, 200 tons, worth £800 (quantities of cottonseed and cottonseed cake exported during the last year or two have much diminished, but quantities of the oil have increased); rape and mustard seed, 59,100 tons; rape and mustard seed oil, 488,771 gallons; sesamum seed, 16,000 tons, worth £225,000; groundnuts, 118,152 tons; groundnut cakes, 49,900 tons; castor seeds, 86,101 tons, worth £1,017,373; castor oil, 2,086,038 gallons, worth £255,560.

Oil pressing is carried out in India by medieval methods; the problem of treating all seeds locally, instead of exporting them, is being attacked. The question of manufacturing pure vegetable margarines is also of importance.

Linseed is one of the most important crops grown in India; the cottonseed oil industry is still in its infancy, much of the seed being fed to cattle. The oil content of Indian cottonseed is 18 per cent.; that of American seed 23 per cent. India is probably the largest centre of production of rape (colza) oil; the seed contains 42—45 per cent. of oil. Sesamum is grown mainly in India, and the seeds con-

tain about 44 per cent. of oil. Arachis (groundnut) oil is grown chiefly in Madras, Bombay and Burma. India is the main source of the world's supply of castor oil; this oil is converted into "Turkey red oil" by means of sulphuric acid, an industry dependent on the price of the acid. Coconut oil is produced mainly on the West Coast; the export of mowhra has latterly greatly diminished. There are numerous other oils, trade in which might be developed.

Exports during recent years have been :—

Year	Oil Seeds		Oils		Oil cakes	
	Quantity Tons	Value £	Quantity Gallons	Value £	Quantity Tons	Value £
1912–13 ...	1,217,089	15,022,009	24,489,692	571,945	161,785	821,387
1913–14 ...	1,572,792	17,000,385	25,991,315	657,085	175,313	920,249
1914–15 ...	946,727	9,669,897	30,245,651	701,357	136,932	709,219
1915–16 ...	641,983	6,582,017	33,081,357	812,571	150,286	757,501
1916–17 ...	919,853	10,772,618	30,904,841	1,007,151	124,996	660,697
1917–18 ...	431,737	5,052,062	26,755,953	1,326,441	86,159	471,665

old village sites in Bihar and the Punjab; but Indian potash is unlikely to compete with that from other sources. The manufacture of zinc salts in India could be developed. The manufacture of aluminium sulphate and alums from pyritic shale has long been an Indian industry. Alum cake is also made from bauxite. Considerable quantities of aluminium sulphate and alum are imported. Litharge and red lead are made on a considerable scale, and the manufacture of white lead is likely to be started. Deposits of chrome iron ore in

Alkaloids.—On account of its variety of climates, India is suitable for the extended cultivation of alkaloidal plants. The production of cinchona and opium products has been undertaken by Government. Supply, however, is unequal to demand, and in 1917—18, 29 tons of quinine and its salts, worth £105,660, was imported. Morphine is now being manufactured at the Opium Factory, Ghazipur. Hitherto seeds of *Strychnos nux vomica* have been exported; now the extraction of strychnine and brucine is being attempted. The export of nux vomica in 1917—18 amounted to 1962 tons, worth £25,329. It is proposed to form a Drugs Manufacturing Committee to stimulate the cultivation of alkaloids in India.

Natural Dyes.—India is very rich in natural dyes, of which the following are exported: Indigo, cutch, safflower, turmeric, annatto, red sandalwood. Heavier crops of indigo are being obtained by the use of phosphatic manures; the following figures show that the cultivation of this dye has considerably increased during the war (see this J., 1919, 119R) :—

Indigo.

Year	Acreage	Exports Tons	Value £
1912–13 ...	227,046	593	146,755
1913–14 ...	169,221	547	141,938
1914–15 ...	145,792	857	599,691
1915–16 ...	351,265	2096	1,385,795
1916–17 ...	770,000	1677	1,382,931
1917–18 ...	710,600	1456	957,985

Disinfectants and Antiseptics.—Much bleaching powder is imported into India for sterilising and bleaching purposes, the figures for 1917—18 being: Bleaching powder, 1510 tons, worth £51,531; bleaching materials, 5012 tons, worth £139,398. Other disinfectants imported in 1917-18 amounted to 1571 tons, worth £67,415. Small quantities of carbolic acid disinfectants have been made in India since the outbreak of war.

Fertilisers.—Although essentially an agricultural country, India uses few fertilisers. Bones are exported from India in steadily diminishing quantities. Thus in 1914—15 63,975 tons, worth £319,553, and in 1917—18 26,679 tons, worth £102,389, were exported.

Minor Products.—Considerable quantities of sodium sulphate are produced in India, and used in cotton mills, in the manufacture of glass, and for dehydrating oils; little is imported. Appreciable amounts of potassium nitrate are recovered from Mysore, Baluchistan and Singhbhum are being opened up, and attempts have been made on a small scale to manufacture chromium compounds. Ferrous sulphate has been made in India since the outbreak of war, as well as oxalic acid on a small scale. Citric acid could be made from limes, and tartaric acid from the pulp of tamarind fruit.

THE INTERNATIONAL RESEARCH COUNCIL.

At the meeting of Inter-Allied scientific delegates held in Brussels on July 18-28 last, the International Research Council was declared duly constituted for the purposes of co-ordinating international efforts in pure and applied science, of initiating the formation of international associations or unions, of directing international scientific action in subjects which lie outside the scope of existing associations, and of entering into relations with the Governments of the participating countries on matters falling within its competence. The following nations are now represented on the Council: Australia, Belgium, Brazil, Canada, France, Greece, Italy, Japan, New Zealand, Poland, Portugal, Rumania, Serbia, South Africa, the United Kingdom, and the United States. The adherence of nations, other than the Central Powers, may follow at their own request or, on the proposal of a constituent nation, by a three-fourths majority vote of the Council. The nations which remained neutral during the war are invited to join the Council and the international unions represented upon it. A General Assembly will be held every three years, and the affairs of the Council will be managed by an Executive Committee during the intervening periods. The first Executive Committee consists of Prof. E. Picard, Dr. A. Schuster, Profs. Hale, Volterra and Lecointe. The permanent seat of the Council is to be at Brussels and the secretariat will reside in London, where a room has been placed at its disposal by the Royal Society.

The meetings of the delegates appointed by the Inter-Allied Chemical Conference in London (this J., 1919, 262 R) were held in the Palais des Académies de Belgique. Prof. A. Haller, who presided, announced that the referendum taken among the members of the Council of the pre-existing International Association of Chemical Societies showed a large majority in favour of dissolving that body. It was accordingly declared to be dissolved; and it was decided to return the endowment fund

presented to it by M. Ernest Solvay to the donor. A report on the proceedings of the London Conference was presented by M. Moureu, and the recommendations therein approved. The Rules were first adopted in principle only, as it was found necessary to modify some of them in certain minor respects in order to render them conformable to the requirements of the International Research Council and to make them fit into the framework of the associated international unions. A special committee, composed of one delegate from each of the nations represented, having effected these changes, the Rules were formally adopted. At the subsequent General Assembly the appointment of the officers ("Bureau") nominated by the London Conference was confirmed, and this Bureau then submitted the Rules successively to the Executive Committee of the Council and to the International Council at a plenary sitting, by whom they were approved

The official title of the international chemical federation is now *L'Union Internationale de la Chimie pure et appliquée*—the International Union of Pure and Applied Chemistry.

The general idea is that each adhering country will have its own national union, association or federal council for each distinctive branch of science (*e.g.*, the Federal Council for Pure and Applied Chemistry in the United Kingdom); that the international unions will be composed of representatives of the national unions; and that the International Research Council will be constituted of representatives from the international unions.

CONFERENCE ON RESEARCH ORGANISATIONS.

A well-attended conference was held at the Board of Education on July 29 to discuss certain difficulties connected with the organisation of Research Associations formed under the scheme of the Department of Scientific and Industrial Research. Sir William McCormick, who presided in the absence of the Rt. Hon. H. A. L. Fisher, remarked, in his opening statement, that nine research associations are now in being, eight have been approved by the Board of Trade and only await a licence, and twelve are in process of formation.

The vexed question as to ownership of results of research evoked considerable discussion. Sir Frank Heath stated that such results have been officially declared to be the property of the associations: they will be communicated to the projected Records Bureau connected with the Department, which will classify them, according to the wish of the Association, as confidential or non-confidential. Confidential results will not be communicated to anyone except with the consent of the body which transmitted them, but in cases where disclosure would be obviously desirable, the Bureau would endeavour to effect the transference of information. The Bureau will assist research associations in obtaining rare publications, but each association must have its own bureau as well as a library. The central bureau could not supply abstracts of literature, but it would draw attention to original sources of information. It is hoped that the expenses of the Records Bureau will be defrayed out of the annual Parliamentary grant.

A discussion then ensued on the question of rewards for individual research workers. The feeling of the meeting was strongly against such rewards, but it was suggested that a bonus on results might be given to a team of workers, and that individuals might be compensated by increase of salary. The allied problem of the desirability of allowing a worker to patent a discovery if his association declined to do so, also raised considerable discussion. Col. O'Gorman said that in his experience the proof of good organisation is team work, and the latter is killed by individual secrecy and working with the intent of making money from a patent. Mr. W. Dixon suggested that an employee might be allowed to take out a patent on the condition that his employer had a free use of it for all time. Sir Charles Parsons said that legal decisions in such cases were always against the employee; a man might patent the product of his own work in his own time, but not if it were the result of work done in his employer's time.

On the subject of co-operation among research associations in respect of matters of common interest, Sir F. Heath advised the appointment of joint committees *ad hoc* with strict terms of reference; and Mr. J. P. Hinchliffe suggested that two or three members of an association might be elected on to a kindred association, and *vice versa*.

The last topic of discussion was on methods of levying subscription rates. The Departmental memorandum on the subject suggests methods based on capital employed, average annual profits, annual wages bill, number of employees, volume or value of output, and amount of plant. None of these appears to be entirely satisfactory, and Sir William Jones stated that the Refractories Research Association had discarded all of them, and had come to the conclusion that a voluntary basis would be best as it would obviate the disclosure by manufacturers of information regarding their business. It was not suggested, however, that this plan was feasible for other associations.

PERSONALIA.

Madame Curie has been elected to the chair of radiology at the University of Warsaw.

Professor F. Giolitti, of Turin, has been awarded the Bessemer Medal of the Iron and Steel Institute.

Prof. Ernst Haeckel, the well known German biologist, died at Jena on August 8 at the age of 85.

The Henry Overton Wills chair of physics at Bristol University has been filled by the appointment of Prof. A. M. Tyndall.

Dr. J. C. Meakins, of McGill University, Montreal, has been appointed professor of therapeutics in the University of Edinburgh.

Lord Lee of Fareham has been appointed President of the Board of Agriculture and Fisheries, and Sir Eric Geddes Minister of Transport.

Prof. A. G. Vernon Harcourt, formerly professor of chemistry in the University of Oxford and past-president of the Chemical Society, died on August 23, in his 85th year.

Capt. B. J. Eaton has received the Order of the British Empire (O.B.E., Military Division) for war services. He has also received the thanks of the Secretary of State for the Colonies and the Federated Malay States Government for researches on rubber.

H.M. the King, on the occasion of the celebration of his birthday, signified his intention to confer a baronetcy of the United Kingdom on Colonel H. G. Barling, M.B., F.R.C.S., Vice-Chancellor of Birmingham University; and the honour of knighthood upon Prof. W. Boyd Dawkins, professor of geology and palæontology in Victoria University, Manchester, and Mr. J. W. Y. MacAlister, secretary of the Royal Society of Medicine.

NEWS AND NOTES.

BRITISH INDIA.

Industrial Scholarships.—A press note issued by the Director of Industries, United Provinces, states that at the seventh meeting of the Industries Section of the Board of Industries held at Naini Tal on June 14, 1919, the following among other matters were dealt with :—It was decided to recommend to Government that State Technical Scholarships in the following subjects be awarded during the year 1920: (1) Glassmaking, (2) the Dyeing of Textile Fabrics, (3) Electrical Engineering. On a previous occasion a scholarship in glass-making had been suggested by this Board, but as it was subsequently explained that facilities did not exist in England for giving a really first-class training, the matter was not proceeded with. The Board expressed the opinion that it was possible for conditions in this industry in England to have altered considerably since then, but if such should not be the case, arrangements might be made for the students to be trained in America or Japan, preferably in the former country. For the purpose of carrying out experiments in the manufacture of glass using the sodium carbonate which is manufactured locally from Reh deposits, the Board recommended that a grant of Rs. 5000 be set aside.—(*Official.*)

CANADA.

New Cyanide Plant.—It is now officially reported that the Cassel Cyanide Company will undertake the erection of a plant in Canada for the production of cyanide suitable for the use of the mining industries of the country, more particularly for those situated in Northern Ontario.

Canadian Chemical Industries.—The Dominion Government has, through its Department of Statistics, prepared a Directory of Canadian Chemical Industries. The information is complete to January 1919, and will be the first publication of this kind to be issued in the Dominion. It is the result of urging on the part of the Society of Chemical Industry, and action on the part of the Honorary Advisory Research Council. Some 634 firms are listed, and their names and products are given alphabetically. The directory also gives a very complete summary of the chemical industries of the Dominion and of the business done during the last six years.

Research in Alberta.—The Provincial Government of Alberta is seriously considering the question of establishing a research department to assist in guiding and co-ordinating the development work in connexion with the natural resources of the province. Coal, oil, natural gas, and salt are among the resources upon which the province hopes to build up industries of great magnitude. The Hon. A. G. McKay, Minister of Industries, and Prof. R. D. MacLaurin, of Saskatoon, are leading in the matter of bringing these problems before the public. The Industrial Convention in Medicine Hat in August should result in the announcement of a definite policy regarding the establishment of a provincial fund for research work.

Meeting of Maritime Chemists.—Chemists in the Provinces of New Brunswick and Nova Scotia are organised under the Maritime Chemists' Association. On July 15 they held their annual meeting at Sydney, N.S., which is an important centre of the steel and coal industries in Eastern Canada. A paper was read on "The Use of Benzol and Benzol Mixtures as Motor Fuel," by Mr. I. C. Mackie, who is chief chemist to the Dominion Iron and Steel Corporation of Canada, and during the war period was closely associated with the development of the large new benzol plant of that company. In the district the use of benzol and solvent naphtha for motor fuel has been steadily increasing. The difficulties of overcoming prejudice in the introduction of this fuel were dealt with, and in particular the effect of benzol on cork floats in carburettors and the question of the strength of the mixture necessary for complete combustion.

Mr. A. Blake, Chief Chemist of the Atlantic Sugar Refineries, St. John, N.B., gave a paper on "The Examination of Coals," and another was read by Dr. A. McGill, of Ottawa, on "The Chemists' War."

At the regular business meeting committees were appointed to consider the question of establishing a Section of the Society of Chemical Industry in Eastern Canada, and to urge the Provincial Governments to have Canada represented at the Exposition of Chemical Industries to be held at Chicago in September. Mr. H. B. Vickery, of the Imperial Oil Co., Halifax, is secretary of this organisation.

AUSTRALIA.

Mineral Production in New South Wales in 1918.—Owing to the high price of metals in 1918, the value of the mineral output of New South Wales attained the record figure of £14,391,981. Gold, which is now obtained principally from copper ores, showed a small recovery at 87,145 oz., valued at £369,473. The copper output was worth £696,580, of which £501,685 was extracted from the Great Cobar mine. The value of the tin produced was £548,876, compared with £373,696 in 1917; the output of the silver-lead mines was worth £5,712,138.

The aggregate mineral production of the State now amounts to £300,499,184, of which coal accounts for £92,721,420, silver-lead £86,235,094, gold £62,368,521, copper £14,988,804, zinc £13,000,000, and tin £11,511,880.

The coal production and coal trade of the State have been much interrupted by labour troubles, etc., and the Commonwealth Government has announced its intention of taking over the mines. Owing to the closing down of the metalliferous industry, the demand for coke has much diminished. The value of last year's output was £387,000, of which more than half was produced in the Illawarra District.

The State Department of Mines has recently issued a report on the limestone industry. The value of the annual production is now above £500,000 and its rapid growth is due primarily to the marked increase in the manufacture of Portland cement. The methods used in lime-burning are essentially the same as those employed twenty-five years ago, and the average output of lime is valued at £27,500. The production of marble is increasing. The report gives detailed information concerning the occurrences of limestone and dolomite with analyses.—(*Bd. of Trade J., July* 17, 1919.)

SOUTH AFRICA.

The Transvaal Gold Mines in 1918.—The Transvaal gold mines made profits in 1918 totalling £7,678,129 as against £10,486,283 for the previous year, a decrease of £2,725,368. The dividends declared in 1918 amounted to £5,273,633, which total is £1,444,971 less than that for 1917. Particulars given in the Chamber of Mines' progressive statement of gold production are as follows :—

	1918	1917
Tons milled	25,267,302	27,862,851
Stamps	8,878	9,470
Tube mills	338	332
Value of output	£35,768,688	£38,323,921
Total per ton milled ...	28/1	27/3
Total working costs ...	£27,318,600	£26,857,837
Costs per ton	21/8	19/4
Profit per ton	6/1	7/6

—(*Official.*)

UNITED STATES.

Engineering Chemistry.—A movement is on foot to establish a school of chemical engineering at the University of Michigan, the funds for which will be furnished by the State Manufacturers Association. The manufacturers are favourable to the plan and it only remains to work out certain details with the University authorities.

Zinc as a Structural Material.—Following the greatly stimulated production of zinc during the war, the American producers are now taking a renewed interest in extending the use of zinc, especially as a structural material. Zinc has many qualities of value in this direction, but its limiting characteristics are low strength, high thermal expansion, the tendency of wrought zinc to recrystallise and become brittle at low temperatures, its relatively low ignition point, and the ease with which acids and alkalis attack it. A campaign of education among builders is to be initiated.

Malleable Castings.—After four years of research the American Malleable Castings Association reports progress of the most practical kind. Whereas the ultimate strength of the casting formerly averaged 39,882 lb. and the elongation less than 5 per cent., the average from January, 1917, to March 31, 1919, was 51,000 lb. ultimate strength and 12.5 per cent. elongation. During March, 44 per cent. of the bars submitted from some one heat of each day's run by each member showed 52,000 lb. and 14.67 per cent. elongation. The real purpose of the research is to secure uniformity of product upon which an engineer can rely and without which malleable iron castings cannot hold their place. The research is exhaustive in nature and several generally accepted theories are being overthrown.

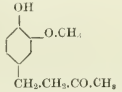
The Chlorine Plant at Edgewood, Maryland.—The largest chlorine plant in the world has been practically embalmed in such a way that should it become necessary to again put it into operation no time would be lost in doing so. This plant is a part of the Edgewood Arsenal at Edgewood, Maryland, and has a capacity of 100 tons of chlorine per twenty-four hours. The contract for the plant was signed on March 3, 1918, the location was decided on March 27, the necessary railroad was ready May 8, the shop building was begun May 10, and on August 1, 1918, the first circuit of cells was ready to operate. Nelson cells were employed and the plant was started and operated without any change in original designs and without any difficulty. The quality of the gas was such that liquefaction for use in manufacturing phosgene was not needed, but the installation included a liquefying plant as liquid chlorine was required for other purposes.

Copper Production in 1918.—The smelter production of primary copper in the United States during 1918 was 1,908,500,000 lb., valued at $471,408,000, showing an increase of 1·17 per cent. in quality and a decrease of 8·45 per cent. in value compared with 1917. The total production of new refined copper was 2,432,000,000 lb., or 4,000,000 lb. more than in 1917; and the regular refining companies also produced copper sulphate having a copper content of 7,917,696 lb. Stocks at January 1, 1919, were 180,000,000 lb., or 66,000,000 lb. more than at January 1, 1918; and 562,600,000 lb. of blister copper and material in process of refining was reported at smelters, in transit or at refineries, against 411,000,000 lb. in the previous year. The apparent consumption of refined new copper in 1918 showed an increase of 346,000,000 lb. over 1917 at 1,662,000,000 lb.

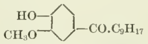
Cane Sugar in Porto Rico.—The cession of Porto Rico to the United States by Spain in 1898 was followed by a marked increase in the production of sugar, due not only to the establishment of new plantations, but more especially to the introduction of more up-to-date machinery. The establishment of Free Trade between the United States and Porto Rico in 1901 beneficially affected the sugar industry. The individual cane plants are propagated by cuttings; seeds are only employed by experimental stations for the purpose of creating new varieties. The plants ripen after 12—18 months and give an average yield of 40 tons of cane per acre and about 4 tons of sugar per acre. Although the soil of Porto Rico is very fertile it must be well prepared by deep ploughing and proper surface cultivation since the plants remain on the same field for at least four years. In recent years artificial manuring has been taken up, in the form of sulphate of ammonia, superphosphate and sulphate of potash. Chlorine manures are avoided since they act unfavourably on the formation of sugar in the cane and subsequently on the purity of the juices.

JAPAN.

The Hot Constituent of Ginger.—Thresh gave the name "gingerol" to the hot constituent of ginger, which was isolated by Garnet and Grier who did not, however, determine its molecular formula. Recently H. Nomura, an assistant professor of Sendai University, has completed his researches on the subject, and published the results. He has found that the hot constituent consists of at least two different compounds, one of which called "Zingerone" is a crystalline solid having m.pt. 40°—41° C., molecular formula $C_{11}H_{14}O_3$, and the constitutional formula



The second constituent, named "Shogaol" ("Shoga" being the Japanese name for ginger), was also separated. Its molecular formula is $C_{17}H_{24}O_3$, and its constitution is represented by



being an α β unsaturated ketone.

Manufacturing Cost of Phenolphthalein. — The Research Institute for Hygiene at Osaka has recently published the result of an investigation on the manufacture of phenolphthalein. The present cost in Japan is stated to be :—

(1) *Phthalic anhydride.*

	Grms.	Yen·
Naphthalene	1,125	0·350
Sulphuric acid	12,562	1·954
Mercury	281	2·498
Commercial caustic soda	344	0·191
Commercial hydrochloric acid ...	640·5	0·068
Total for 271·1 grms. of the product ...		5·061

That is, Y.8·40 per pound of the product (approx. 17*s.* 3*d.* per lb.).

(2) *Phenolphthalein.*

	Grms.	Yen.
Phthalic anhydride	250	4·667
Phenol	500	0·867
Sulphuric acid	200	0·156
Caustic soda	80	0·356
Acetic acid	333	0·222
Absolute alcohol	533	1·776
Bone charcoal	50	0·256
Total for 182·9 grms. of the product ...		8·39

That is, Y.20·421 per pound of the product (approx £2 13*s.* per lb.). (Yen—2*s.* 0½*d.*)

Mineral Oil Industry.—With increased supplies of necessary plant and material, increased activity in the Japanese oil industry is anticipated during the current year. Several fresh schemes have already been taken in hand. Drilling is expected to be soon under way in the naval oil reserve fields of Formosa as well as in Nairyo and Kosempo. The Akita Mining College is to open a course in petroleum engineering, the first of its kind in Japan. The Nippon Oil Co. has built new plant at its Echigo refinery at a cost of $100,000. Owing to the prohibition of the exports of drill pipe from the United States development was held back during 1917—18 and production showed a decline. On the other hand, increased prices for oil, improved refining methods, and the increased utilisation of casing-head gasoline brought increased profits.—(*Indian and Eastern Engineer, July* 1919.)

GENERAL.

The Non-Ferrous Mining Industry.—The President of the Board of Trade has appointed a Departmental Committee to investigate and report upon the present position and economic possibilities of non-ferrous mining in the United Kingdom, and to make recommendations as to such Government action as may be expedient in regard thereto. The members of the Committee are Mr. H. B. Betterton, M.P. (chairman), Mr. H. F. Collins, Mr. J. Harris, Dr. F. H. Hatch, Sir Lionel Phillips, Bart., Mr. R. A. Thomas, and Mr. James Wignall, M.P. All communications should be addressed to the secretary, Mr. W. Palmer, Gwydyr House, Whitehall, S.W. 1.

The British Non-Ferrous Metals Research Association.—About a year ago a meeting was held of representatives of the non-ferrous metals industries and a provisional committee was appointed to take steps to form an association under the scheme of the Department of Scientific and Industrial Research. A memorandum and articles of association have since been drawn up and approved by the Department, and as soon as a licence has been received it is proposed to establish the Association upon a permanent basis. In addition to promoting technical efficiency in the production, treatment and utilisation of non-ferrous metals and alloys by the establishment of a research institute and experimental workshop, it is intended to institute an information bureau with branches in various centres. The method of assessing a firm's annual subscription will be decided by the Association in general meeting, but in the meantime the levy will be based upon the capital employed in the business, with a minimum subscription of £25. The officers of the provisional committee are: Mr. Thomas Bolton (chairman), Mr. F. Tomlinson (vice-chairman), and Mr. E. A. Smith (secretary), of 30, Paradise Street, Birmingham.

The Position of Chemists in the Special Brigade, R.E.—A correspondent wishes to draw attention to the hard case of chemists who were enrolled as such in the Special Brigade of the Royal Engineers early in the war. During the early days, from May 1915, the work of the Brigade, he states, was suitable for plumbers and navvies, and in the later stages the only technical knowledge required was that of joining electric wires and testing for "breaks," digging and carrying being the principal tasks. This contention, he continues, is borne out by the fact that beyond the original "Chemist Corporals" very few of the N.C.O.s in the Brigade have been professional men. The plea of "national necessity" which might be advanced to excuse their treatment during the war is certainly not applicable at the present time, when they are being transferred to fill the positions of clerks, storekeepers or checkers.

The German Nitrogen Industry.—In a statement made to *The Times* (August 19), Dr. E. C. Worden, of the United States Bureau of Aircraft Production, describes the nitrogen works of the Badische Anilin und Soda Fabrik at Oppau, near Ludwigshafen. Aided by a Government loan of nearly 200 million marks, this factory, he states, has been started since the armistice and when completed will have a storage capacity of 350,000 tons of ammonium fertiliser and a daily capacity of 2800 tons. Between 8000 and 9000 men are being employed. This building, which is only one of seven under construction, possesses a storage shed equal in area to the site of St. Pancras Station and is well furnished with automatic machinery, plant in duplicate and some 3500 telephones. Its cost to date is about £150,000. Dr. Worden also states that the firm of Fr. Bayer at Leverkusen has substantially 3000 tons of dyes, chemicals and pharmaceutical products, either finished or in process of manufacture, ready for exportation.

Low Temperature Carbonisation.—Further particulars have been supplied by T. C. Clarke of the low temperature coal-carbonisation process referred to in this J., 1919, 292 R. The process comprises three stages: (1) low-temperature distillation at about 800° F. (=427° C.), (2) briquetting the resulting soft friable semi-coke, and (3) submitting the briquettes to high-temperature distillation. In the first stage the coal is carbonised in heart-shaped retorts containing two shafts to which are fixed paddles rotating at the rate of one revolution in eight minutes, the coal being carried forward at the rate of one ton per hour. The coal is preheated to 300° F. (=149° C.) in a rotary heater. In the briquetting stage, pitch recovered during the carbonisation stage is restored to the coke and is thoroughly mixed therewith in either the solid or liquid form. The mixture is briquetted, and the briquettes exposed to the air for 10 minutes. In the third stage, the air-dried briquettes are exposed to a temperature of about 1800° F. (=982° C.) in a secondary retort, the floor of which is inclined at an angle, so that the briquettes do not crush one another while in a comparatively soft state, and roll down when the discharge doors are opened. The briquettes are quenched in the usual manner. The yields anticipated from an English coal containing 30 per cent. volatile matter in a plant carbonising 100 tons per day are: coke briquettes, 75 tons; motor spirits, 250 galls.; light naphtha, 100 galls.; heavy naphtha, 200 galls.; tar acids, 425 galls.; fuel oil, 625 galls.; sulphate of ammonia, 1·56 tons. Results are given of the yields obtained by the carbonisation of Clinchfield coals and Japanese lignite. To the coke briquettes the term "carbocoal" is applied. The percentage of ash therein is necessarily higher than that of the coal whence it is derived. Steam-raising tests conducted by the Pennsylvania Railroad Company gave an evaporation of 11·1 lb. of water from and at 212° F. per lb. of dry carbocoal (cal. value 12,438 B.Th.U. per lb.), corresponding to a boiler efficiency of 86·2 per cent. Raw coal (cal. value 13,009 B.Th.U. per lb.) from the same source gave an evaporation of 10·87 lb. of water and an efficiency of 81·1 per cent. In the tests the carbocoal was burnt without smoke at a rate of 165 lb. per hour per sq. ft. of grate. Tests made by the United States Navy Department indicated that Pocahontas coal with 11·5 per cent. higher calorific value gave only 5·3 per cent. higher evaporation duty. The United States Fuel Administration has co-operated with the Ordnance Bureau in the construction and operation of a plant possessing an eventual capacity of treating 1,500,000 tons of bituminous coal annually. The plant was to be in operation early in 1919.

With regard to the friability of coke derived

from low-temperature carbonisation processes, F. Mollwo Perkin instances the recent despatch of 50 tons of coke under adverse weather conditions in this country. After being handled twice, the coke arrived in almost the same condition as it was sent.—(*Times Engineering Supplement, Aug.* 1919.)

Manufacture of "Natalite" in British East Africa.—Owing to the shortage of petrol in East Africa, the Natalite Motor Fuel Co., Ltd., of Natal, has extended its operations to that colony, where the spirit is being made by a new company. Machinery to the value of £17,000 has been installed; it was purchased in France (£10,000) and in the Cape Province. As sugar and other products from which "Natalite" is made exist in abundance in East Africa, the future of the industry in that country is assured, the more so owing to the increased imports of motor cars and the shortage of petrol in the country. The fuel is also expected to be of value for aeroplanes, as it does not readily freeze.—(*Times Trade Suppl., Aug.* 16, 1919.)

Vegetable Oil Production in Southern France.—Olive oil from the Bordeaux district has acquired a world-wide reputation for quality and delicate flavour, and especially popular is a grade of oil obtained in the Bordeaux refineries from a crude oil which comes from Nice. During the war little oil has been exported, the bulk of the production being consumed in France. With the olive crop, abundant production occurs only in alternate years, and, as last year was the good one, the present harvest will not be very large.

The extraction of groundnut oil was established in Bordeaux in 1867, and the industry is now in the hands of one firm with a number of branches at Bordeaux and Marseilles. This firm has 150 collecting depôts in West Africa and imports the nuts in its own steamers. The Bordeaux plants can deal with about 96,000 tons of nuts (in shells) per annum, while the Marseilles refineries have a daily output of nearly 80 tons of superior oil.—(*U.S. Com. Rep., June* 7, 1919.)

Oil and Fat Industries at Esbjerg (Denmark).—A small company was formed in 1916, with a capital of about £2500, for the production of edible bone fat, meat extract and bone meal. About 50 tons of fresh bones is treated per month. The process consists in steaming the bones to remove the fat, and then grinding them to meal suitable for manure and cattle food. A certain amount of meat juice settles from the fat and is collected and concentrated to a bouillon. The latter product was formerly sold to Germany, but recently the demand has dropped and a stock of 50,000 kilo. has accumulated. The bone fat is used locally and sells at about 1*s.* per lb. A Copenhagen firm (Danske Oliemoller Saebe Fabrikken) has recently erected a plant for the manufacture of oils from copra, soya beans, groundnuts and cotton seed. The present plant cost about £200,000, and a refinery for the production of edible fats is projected. The benzine extraction process has been adopted, owing to the higher yields obtained, but in allowing for extensions provision has been made for installing oil presses if needed. The company is purchasing copra and soya from Asiatic Russia and cotton seed from Egypt. The plant at present consumes about 20 tons of coal and ½ ton of benzine per day.—(*U.S. Com. Rep., June* 5 *and* 7, 1919.)

Chemical Information Bureau in Jugo-Slavia.—Engineer M. Rojan has opened a technical bureau for chemical industry in Zagreb, more particularly in connexion with the sulphuric acid, superphosphate and tar distillation industries.—(*Z. angew. Chem., June* 6, 1919.)

Production of Iron Ore in the U.S.A. in 1917.—The iron ore mined in the United States during 1917, exclusive of that containing 5 per cent. or more of manganese, amounted to 75,288,851 gross tons. Of the iron ore mined, 94 per cent. was hematite; brown ore and magnetite furnished little more than 6 per cent. of the total production. The Lake Superior district produced nearly 85 per cent. of the total ore mined.

The average price per gross ton was, hematite \$3·12, brown ore \$2·95, and magnetite \$4·29, representing a general average price of \$3·15 per gross ton in 1917 which, compared with \$2·34 in 1916, shows an increase of nearly 35 per cent.—(*U.S. Geol. Survey, April* 1919.)

Quicksilver in 1917.—The production of quicksilver in 1917 in the United States rose to 36,159 flasks (of 75 lb. net) and was the highest since 1883. It was obtained almost wholly from previously productive deposits. The demand for quicksilver is increasing in greater proportion than the supply, hence a fall in price is unlikely.

The cost of production is very variable, low grade Californian ores containing about 0·38 per cent. recoverable quicksilver costing from \$65 to \$70 per flask to produce and sell. The Government purchase price was \$105 per flask and the San Francisco market price varied from \$80 to \$140.

The richest ores in the world are those of Almaden, Spain, where the average yield for 1917 was nearly 7 per cent. of metal. The Californian average yield was 0·38 per cent. and that of Texas 1·42 per cent. Wet gravity concentration of ore has not proved successful, but an experimental oil flotation plant gave promising results. The substitution of wooden for brick condensers constitutes a great economical advance due to the retention of mercury by the brick structures; 335 flasks of quicksilver were obtained directly by passing about 8000 tons of "earth" from the sites of old furnaces through a washer. The Scott shaft furnace is the standard type used, but retorts can be successfully used on rich ores, although their use is attended with the danger of mercurial poisoning.—(*U.S. Geol. Survey, March* 1919.)

The American Lime Industries.—In 1917 3,440,000 tons of lime was produced by 595 plants in the United States at an average price of 26*s.* per ton, being a decrease of 7 per cent. in output and an increase of 28 per cent. over the price in the previous year. Prior to the war over 1000 plants were employed, but the output has remained the same though the number of plants has been so greatly reduced. It is reported that the increase in cost of production is greater than the increase in the selling price. The State of Pennsylvania produced about one-quarter of the whole output, the remainder being produced by most of the States in relatively small percentages. Ohio, however, produces one-eighth.

The quantity of lime used for building and agriculture decreased notably in 1917, but that used in paper-making, tanning, blast furnaces, chemical works and sugar factories all increased, the most notable increase being in the sugar factories, which used double the normal amount of lime, though this is only about 1 per cent. of the total lime produced. Pennsylvania produced 42 per cent. of the lime used as a flux in the iron and steel industries, and the average price of lime for this purpose rose from 16*s.* 8*d.* per ton in 1916 to 22*s.* 8*d.* in 1917. The quantity of lime used for chemical purposes passed all previous records, amounting to 700,000 tons—an increase of 24 per cent.

Hydrated lime, chiefly used for building and agriculture, after increasing annually for several years declined about 1 per cent. in quantity but

increased 28 per cent. in value. The amount produced is nearly 19 per cent. of the total lime burned in 1917; this is practically the same percentage as in 1916.

About 7000 tons of lime was imported into the United States in 1917, about the same amount as in 1916, almost the whole of which came from Canada. The total quantity exported was 17,000 tons, chiefly to Canada, Mexico, and Central America.

The fuels used for burning lime in the United States are coal, wood, oil, natural gas, producer gas, coke and shavings. Of the kilns used for burning lime 32 per cent. consists of continuous vertical runner kilns in which the fuel and limestone are fed in alternate layers, 61 per cent. of continuous shaft kilns in which the fuel is kept separate from the stone, 1 per cent. of rotary kilns, and 20 per cent. of intermittent or unspecified types.—(*U.S. Geol. Survey, May* 1919.)

The Cohune Nut Industry in Honduras. — The carbonised shell of the cohune nut was found to be one of the best forms of charcoal for use in gas masks, and during the war the United States Government organised a large industry in this material. Although the need for gas-mask carbon has ceased, a permanent industry may yet be established for the extraction of oil from the kernels. The nuts grow in large clusters on the Manaca palm, one tree yielding about 300 lb. per annum. The nuts are from 1½ to 3 inches long and from 1 to 2 inches in diameter. The shells are over ¼ inch thick, very dense and hard, and special machinery is used to crack them in order to free the kernels for oil extraction. The oil is stated to be superior to coconut oil for edible and cooking purposes. Honduras is the chief source of the cohune nut; in one district alone, in the Aguan Valley, a monthly yield of 10,000 tons could be collected. This district will shortly be opened up by railways.—(*U.S. Com. Rep., June* 6, 1919.)

The Platinum Output of Columbia.—Now that the Russian market is closed, the platinum output of Columbia is of very considerable importance. Outside the Russian Urals, platinum in appreciable amount occurs only in the region of the River Choco, a river of Columbia rising in the Andes. It is anticipated that supplies of platinum from Russia will fall in from 30 to 40 years. The supplies from the region of the Choco river however increase steadily every year. The following table shows the annual output from the respective regions :—

PLATINUM PRODUCTION.

Year	Russia (oz. troy)	Columbia (oz.)
1911	300,000	12,000
1912	185,381	15,000
1913	173,642	15,000
1914	156,775	17,500
1915	107,774	18,000
1916	78,674	25,000
1917	—	50,000

—(*Z. angew. Chem., July* 8, 1919.)

Mineral Oil in Venezuela.—The "Bermudez" Asphalt Lake with an area of 1100 acres is stated to contain asphalt of much better quality than that of Trinidad Asphalt Lake; well-sinking for oil is now proceeding in the vicinity. Asphalt and oil also appear to occur in the Delta Island of Pedernales; and in the west, particularly around Lake Maracaibo, the existence of these minerals appears to be definitely established. There is believed to be a great future for the mineral oil industry in Venezuela, the present production being regarded as a mere fraction of that which will be secured within a few years. Tank reservoirs have been built at La Guaira and Puerto Cabello, and oil fuel is in use on the railways. A refinery is in operation at San Lorenzo, 60 miles south of Lake Maracaibo; and a second one, with a capacity of 6000 barrels a day, is under construction on Curacao Island.—(*Bd. of Trade J., July* 10, 1919.)

The Nipah Palm Industry in British North Borneo.—The Bureau of Science, Manila, estimates that there is 12 per cent. of recoverable sugar in the sap of the Nipah palm (*Nipa fructicans*), which grows extensively in Borneo; and, reckoning on a yield of 4000 galls. of sap per acre annually, calculates that the resultant 4000 lb. of sugar would make the production a commercial success.

The manufacture of alcohol from Nipah sap is a well-established industry, the natives of the Philippines having for many years produced a beverage averaging about 25 per cent. alcohol. In 1913, 75 modern distilleries produced 2,500,000 galls. of distilled spirits of which over 98 per cent. is diluted for beverages, the remainder being utilised as fuel. The average cost of collection is about 4*s*. per 100 galls., but in a well-managed area it can be collected and delivered at a cost of two or three shillings. Between 6 and 7 galls. of alcohol can be produced from 100 gallons of sap. Thus the cost of raw material should be between 4*d*. and 6*d*. per gall., while the distillation plant should not cost more than £3000 for a 500 galls. per day unit. The total cost of production, allowing for wages, fuel and interest on investment, should not exceed 10*d*. per gallon. Experts who have operated in the Philippines put the cost of production under favourable conditions as low as 7*d*. per gallon.

The British North Borneo Government estimates that at least 300,000 acres of the Nipah palm exist at very accessible points in their territory, and their Department of Forestry discusses in Bulletin No. 3 the possibilities of establishing this industry. Further information can be obtained from the Secretary, British North Borneo (Chartered) Company, 37, Threadneedle Street, E.C. 3.—(*Bd. of Trade J., Aug.* 7, 1919.)

The Chemical Pulp Industry in Russia.—According to the *Paperjournalen* about 10,000,000 poods (161,000 long tons) of sulphite pulp was manufactured annually in Russia before the war, but owing to the low cost of labour, the factories were operated very inefficiently with old-fashioned machinery. Germany furnished nearly all the machinery, but few German firms were willing to grant the long credit required : this fact accounts for the scarcity of pulp factories in Russia.

During the war a new factory capable of an output of 20,000 tons of dry pulp per annum was built, but many existing ones were destroyed by artillery fire. Notwithstanding disadvantages, the Russian pulp industry has been very profitable because of cheap labour, high prices and the heavy duty preventing importation from countries other than Finland. The consumption of paper increases every year, and in the future competition will be free to all countries without distinction.—(*Bd. of Trade J., Aug.* 7, 1919.)

Re-use of Perished Rubber Bungs.—A simple method for rendering hard perished rubber stoppers again serviceable for use is given in a recent issue of the *Zeitschrift für öffentliche Chemie.* If the rubber stopper is not entirely perished, it can be restored to a usable condition by turning off the hardened external portion in a lathe, the turned surface being finally smoothed with sand paper. The softer the stopper, the greater must be the speed of rotation of the lathe. The hardened surface of a boring in the rubber stopper is similarly removed by means of a round file, the stopper being rotated in a lathe.

PARLIAMENTARY NEWS.

HOUSE OF COMMONS.

Spirit Duty.

In reply to Sir F. Hall who stated that British manufacturers of certain articles cannot compete with Germany on account of the high spirit duty in this country, and asked if such duty could be modified, Mr. Baldwin said that methylated spirit was duty free, and Section 8 of the Finance Act, 1902, allowed the use of pure spirit under certain conditions; no alteration in the law was called for, but he was willing to consider any particular case. —(Aug. 6.)

Gretna Green Munition Factory.

Answering Mr. Rose and Mr. Young, Mr. Kellaway said that the total capital cost of the above factory was about £9,184,000, and the cost of working from September 1916—September 1918 about £12,769,000. The value of the cordite manufactured was about £15,000,000, or £8,600,000 less than would have been required to purchase it from America at 1916 prices. A report on the future use of the factory is now under consideration.

The memorial from the chemists at this factory on the subject of revision of salaries, and a memorandum from the Institute of Chemistry, led to the appointment of a committee of the Treasury to examine the question, which is still sitting. He sincerely regretted that no reply was sent to the memorial. The Department of Explosives Supply had done much to improve the status of chemists employed in industry, and salaries paid by it compared favourably with those paid by private firms before the war, after making full allowance for increased cost of living. The Department is now employing thirty-five chemists and the number is being rapidly reduced.—(Aug. 7.)

The Zinc Industry.

Asked by Mr. Holmes if the National Smelting Co., Ltd., had resumed building operations at Avonmouth, if new arrangements had been made with the Government, and whether the Board of Trade proposes to carry out the recommendations of the Committee on the Sulphuric Act and Fertiliser Trades, Mr. Bridgeman replied that the arrangements made between the Government and the company in 1917 have not so far been modified in any respect. The whole question of the future of the home spelter industry is being considered.—(Aug. 11.)

Coal Consumption.

Mr. Bridgeman, answering Col. Burdon, gave the following figures of coal distribution for the year 1917 (millions of tons):—Total, 183; chemical and allied trades, 5; paper, printing, etc., 2; building, clay and stone, 6½; textiles, 9; blast furnaces, 19½; electricity works, 7; gas works, 18½; railways (locomotives), 13; and mines (other than coal mines) and quarries, 2½.—(Aug. 11.)

Import Restrictions on Chemicals.

Several questions on this subject were put by Mr. Raffan to the President of the Board of Trade, and were answered by Mr. Bridgeman.

(1) *Q.* If the Licensing Sub-Committee (Dyes Department) of the Import Restrictions Department has the power, before granting permission for the importation of medicinal chemicals, to demand the name of the actual manufacturers as well as that of the consignors and to demand the original invoice and to levy a charge of 1 per cent. on it, estimated at the rate of exchange at the time of granting permission to import?

A. Dye intermediates can be imported only under licence and must be consigned to the Central Importing Agency, which is entitled to levy a charge of 1 per cent. to meet expenses incurred. This arrangement has been made by the Licensing Sub-Committee of the Trade and Licensing Committee, and has met with the general approval of all the interests concerned. The name of the actual manufacturer is necessary in order to prevent the indirect importation of German dyes and materials, and the invoice value for the purpose of calculating the agency fee. Chemicals suitable only for medicinal purposes are not included within the scope of the arrangement. The Licensing Sub-Committee of the Dyes Department is distinct from the Import Restrictions Department. No fees are charged by the latter.

(2) *Q.* If the Department of Import Restrictions is inquiring why the requirements of such substances as diethylbarbituric acid, methylsulphonal and santoine cannot be satisfied in this country, notwithstanding the fact that these chemicals are not manufactured in Great Britain to any appreciable extent?

A. No inquiry as to the chemicals named can at present be traced, but it is a matter of routine to inquire of applicants for licences whether their wants cannot be satisfied from home sources. When it is agreed that chemicals which are needed are not manufactured in this country to any appreciable extent licences to import them are freely issued.

(3) *Q.* Whether the Licensing Sub-Committee (Dyes Department) of the Import Restrictions Department has the power to prohibit the importation of such chemicals as antipyrin, amidopyrin and phenacetin, notwithstanding the fact that these chemicals are used entirely for medicinal purposes, and are not in any sense intermediary dye products?

A. The three products named are undoubtedly intermediate coal-tar products, but for the reason stated in the question the duty of issuing licences for them has, by interdepartmental arrangement, been transferred from the Licensing Sub-Committee of the Dyes Department to the Department of Import Restrictions.

(4) *Q.* If the importation of vanillin into this country has been entirely prohibited in spite of the fact that the entire output of British manufacturers has been sold up to the end of September; and whether the effect of this prohibition has been to increase its market price from 45*s.* to 80*s.* per lb.?

A. The importation of vanillin is not prohibited entirely; it is restricted to 50 per cent. of 1915 imports. The suggestion in the latter part of the question is not acceptable.—(Aug. 14.)

Muriate of Potash.

Mr. John Dennis addressed questions to the President of the Board of Trade, to the Parliamentary Secretary of the Board of Agriculture, and to the Minister of Labour concerning the application of a farmers' co-operative society in Norfolk to import 200 tons of muriate of potash. Sir A. Geddes replied that the application, received August 11, had not yet been replied to. The requirements of the company will be filled by the British Potash Company, who hold a licence for the higher grade of potash salt referred to. The Alsace-Lorraine Trading Company does not import the higher grade salts, and if the West Norfolk Farmers' Manure Company, Ltd., has contracted to buy an import-prohibited article it should have first assured itself that a licence would be issued. It is probable that the muriate, which will arrive in the course of the next day or two, will be delivered at a price at least as favourable as that

at which it could be obtained from the Alsace Company. That price will be the f.a.s. price at Rotterdam, as fixed by international agreement, plus incidental expenses.—(Aug. 18.)

H.M. Factory, Queensferry.

Mr. Kellaway informed Mr. Rose that the capital expenditure on building and equipment of the factory had been £4,150,000; the expenditure on wages, approximately, £1,673,000; and the average number of employees from 1915—18 about 2500 men and 2500 women. The value of the total output of the factory is estimated at £19,800,000, and at £33,000,000 at American contract prices. The future of the factory is still under consideration.—(Aug. 18.)

The late Colonel Harrison.

In answer to Brig.-Gen. Croft, Mr. Hope stated that the late Col. H. F. Harrison died in November last of pneumonia, death being accelerated by the effects of the gases to which he had constantly exposed himself since July 1915 in testing gas masks. He left a widow and one son. The original pension of £135 per annum granted to the widow has recently been raised to £300 per annum, with effect from November 1, 1918. He was glad to take the opportunity of acknowledging the distinguished and devoted services of this officer.—(Aug. 18.)

Government Policy.

The Prime Minister, in the course of a three-hours' speech, stated that the Government had decided against the principle of State purchase of the coal mines, but Bills were being prepared for the purchase of mineral rights, for the raising of a fund to secure improvements in housing and social conditions of miners, to amalgamate mines in certain defined areas, and to secure the appointment of workers' representatives on the committees appointed to direct and control the mines in these areas.

The present trade policy would be terminated on September 1. The Government would submit proposals to prevent "dumping" and to protect "key" industries by an import licence system. These industries will probably need financial support for some time, but care would be taken to prevent undue profits. Assistance would be given to invention and industrial research. An Imperial Trade Investigation Board has been constituted to develop trade within the Empire; and a sum of £26,000,000 will be allocated as a banking trade account to enable Serbia, Rumania, Poland, etc., to resume trade relations with this country.

Two Bills introduced that day by the Minister of Labour were intended to introduce a 48-hour week and a minimum wage for all industries.

A Bill was to be introduced to control and develop canals and waterways for industrial purposes.—(Aug. 18.)

Fuel Research.

Mr. H. Fisher, replying for the Prime Minister to Lieut.-Col. Burgoyne, said that the laboratories of the Fuel Research Station at Greenwich are completed and have begun work. The main building will, it is hoped, be finished next month. The estimated total cost of buildings and equipment is £193,588. Experiments on the utilisation of inferior coal and colliery waste will be undertaken after the station is complete.—(Aug. 19.)

HOUSE OF LORDS.

The Patents and Trade Marks Bills.

In view of the lateness of the Session and of the important nature of the Bills, their second reading was postponed until after the recess.—(Aug. 14.)

GOVERNMENT ORDERS AND NOTICES.

IMPORT RESTRICTIONS.

With reference to the Prime Minister's statement in Parliament on August 18 (see previous column), on the subject of trade policy, the Board of Trade makes the following announcement as to the steps which are proposed in connexion with imports of goods from abroad.

Legislation will be introduced when Parliament reassembles in the autumn:—

(*a*) For the protection of goods manufactured in Great Britain and Ireland against "dumping," by taking power to prevent the sale in this country of similar goods beneath their price in the country of origin.

(*b*) To enable the Board of Trade to check any flood of imports (for instance from Germany) that might arise from a collapse of exchange so disproportionate to costs of production in the country of origin as to enable sales to take place in this country at prices altogether below costs of production here.

(*c*) To deal with unstable "key" industries in the following way:—

A limited number of unstable "key" industries will be scheduled, the products of which will be prohibited from importation into this country except on licence.

Pending legislation, a general licence under the Prohibition of Import Proclamations will be issued by the Board of Trade having effect as from September 1, 1919, and authorising the importation into the United Kingdom of all goods with the exception of the following, which will be treated as products of unstable "key" industries:—

(1) All derivatives of coal tar generally known as intermediate products capable of being used or adapted for use as dyestuffs or of being modified or further manufactured into dyestuffs. All direct cotton colours, all union colours, all acid colours, all chrome and mordant colours, all alizarine colours, all basic colours, all sulphide colours, all vat colours (including synthetic indigo), all oil, spirit and wax colours, all lake colours, and any other synthetic colour, dyes, stains, colour acids, colour lakes, leuco acids, leuco bases whether in paste, powder, solution or any other form.

(2) (i) Synthetic drugs (including antiseptics).

(ii) Synthetic perfumes and flavourings; synthetic photographic chemicals; synthetic tannins; esters and acid derivatives of aromatic hydrocarbons; alkaloids and their salts (except quinine); and the following organic chemicals:—Acetamide; acetic acid; acetic anhydride; acetyl chloride; camphor bromide; cinnamic acid and its salts; ethylene bromide; formamide; formic acid and its salts; gallic acid; lactic acid and its salts; nuclein; paraldehyde; pyrogallic acid; saccharin or other substances of like nature or use; salicin; thymol.

(iii) Analytical reagents; and the following fine chemicals:—Barium compounds; cerium fluoride and fluorides of other rare earth metals; hydrosulphites and allied bleaching compounds; hypophosphorous acid; iron and ammonium citrate; iron tartrate; molybdic acid and its salts; phosphorus oxides and halogen compounds; salts of per-acids and artificial peroxides; silver nucleinate and proteinate; tungstic acid and its salts.

(3) Optical glass including lenses, prisms and like optical devices; (4) scientific glassware; (5) illuminating glassware; (6) laboratory porcelain; (7) scientific and optical instruments; (8) potassium compounds; (9) tungsten powder and ferro-tungsten; (10) zinc oxide; (11) lithopone; (12)

thorium nitrate; (13) gas mantles and mantle rings; (14) magnetos.

In addition to the above, in pursuance of the undertaking given by the President of the Board of Agriculture in the House of Lords on March 19, 1919, the prohibition on the importation of hops will be continued for the present.

It is not proposed to make any additions to the above list unless and until Parliament so determines, with the possible exception that in the event of the contingency foreshadowed in paragraph (*b*) above arising, it might be necessary to suspend temporarily all or any of the imports from the country affected by the collapse of exchange.

GOVERNMENT TRADE POLICY.

The Prime Minister has addressed an open letter to the press in which he summarises and gives further particulars in regard to the proposals made by him in the House of Commons on August 18.

Key Industries.—Only such industries which fulfil the following tests will be regarded as "unstable key" industries:—

(*a*) That the product is essential for war, or for the maintenance of the country during war.

(*b*) That the industry had been so neglected before the war that there was an inadequate supply of the product.

(*c*) That the industry is one for the fostering and promotion of which the Government found it necessary to take special steps during the war.

(*d*) That if special Government support were withdrawn, the industry could not maintain itself at the level of production essential to the national life.

It is proposed that the fees charged for the issue of licences to import goods produced by such "unstable key" industries will be fixed in each case with regard to the difference between the price at which the article can be imported and the price at which similar articles can be sold in the United Kingdom. It may be necessary for some years for the Government to continue to assist these industries. Care will be taken that no undue profits shall be made at the expense of the community. Pending the grant by Parliament of the necessary powers to give full effect to this policy, the Government intends to continue the existing import restrictions which affect industries qualified to be regarded as unstable key industries. These will be scheduled and the schedule published at an early date.

Exports.—The Government will endeavour, through the Consular and Commercial Attaché Services, to stimulate the export trade in every direction.

Statistics and Information.—The Government will collect fuller information about production, trade, prices, costs and profits than has hitherto been obtained, and seek any powers that may be requisite.

Standardisation.—It is proposed to set up at the Board of Trade a Department of Standards (1) to promote and co-ordinate standardisation generally, and (2) to establish and administer such testing institutions as may be found necessary, and authorise and, so far as may be required, supervise the testing work carried out by technical institutions, trade organisations or private concerns.

FOREIGN TRADE.

Arabia, Hungary.—The Board of Trade has issued general licences authorising, with certain reservations, the resumption of trade with Arabia and Hungary.

"*Occupied*" *Germany, etc.*—Goods intended for "occupied" Germany, Luxemburg, Alsace-Lorraine, or Switzerland may be shipped at the exporter's option by any of the several routes now available.

Poland.—The Polish Commercial and Financial Agency, 88, Kingsway, W.C. 2, has been authorised to issue import permits, from whom the necessary forms may be obtained. The charges for an import permit are 5*s.* stamp duty, and one-tenth per cent. of the total value of the goods.

Long Term Credits for Export.—The Board of Trade has notified that an office will be opened shortly for furnishing sterling credits for assisting the exportation of goods to certain disorganised parts of Europe. Credits will not be furnished for the export of raw material or for the sale of stocks held by Government Departments.

REPORTS.

Fifty-fifth Annual Report on Alkali, etc., Works by the Chief Inspector, 1918. *Pp.* 81. (*London: H.M. Stationery Office.*) *Price* 2*s.*

The aggregate number of registered works in the United Kingdom in 1918 was 1580, a decrease of 2 on the previous year; this includes 166 works in Scotland. War conditions continued to exert their adverse influences on production and also militated against a full degree of inspection, but in spite of difficulties in maintaining output and effecting repairs, those responsible continued to meet the situation effectively, expending effort even on the extension and erection of plant and the consideration of fresh channels for activity in anticipation of possible post-war changes. From many districts an inferior quality and restricted supply of male labour are reported, but associated with this is the increasing efficiency of female labour. The tendency towards closer co-operation by firms engaged in the same departments of manufacture is again noted, and particular reference is made to a movement for forming a central laboratory for the consideration of questions and problems connected with the tinplate industry in South Wales, whilst the more extended employment of trained chemists in chemical works generally is mentioned with satisfaction as indicative of a more progressive policy.

Alkali Works.—The development of electrolytic methods for producing alkali and chlorine was very considerable, and towards the close of the year the operation of the Leblanc process was materially curtailed through its influence and that of the ammonia-soda process. In the future it is thought that the Leblanc process must yield, as regards the manufacture of alkali, to a combination of the two newer methods, and that the demand for hydrochloric acid and salt-cake, though still necessitating the decomposition of common salt with sulphuric acid, is likely to be met by the output of smaller works distributed more widely throughout the country. In Scotland the use of mechanical furnaces continued to give satisfaction, alike as regards costs and the maintenance of minimum escapes of acid gases. An unusual and fatal accident is reported through the sudden breaking of a salt-cake pot, the contents of which, falling into the fire-flue, caused a blow-back through stoppage of the draught.

Cement Works.—The output was much below the full capacity of the available plant, and it is considered that a great deal has to be done in repairs before normal working conditions can be restored. Little definite progress of a practical character was made towards the recovery of potash from kiln fume, although considerable quantities of the

heavier particles were deposited in flues and utilised for agricultural purposes.

Smelting Works.—In the South Wales district excessive amounts of sulphurous gases were discharged into the air from furnaces which prepare sulphide ores for zinc extraction but do not allow of utilisation of the sulphur acids produced, and it is urged that the use of such furnaces be discontinued as soon as possible. There was a more limited supply of sulphide ores other than those of zinc, partly owing to the development of methods for treating such ores at the mines in other countries. The deposition of fumes by mechanical methods continued in successful operation, whilst electrical methods extended, both as regards the scale of operations and the number of works in which they were adopted.

Sulphuric Acid.—The large increase in productive capacity in works specially erected to meet the abnormal war requirements eased the heavy pressure which was previously in evidence, but the conclusion of the armistice led to new plants erected on modern lines not being put into operation, while several plants already in operation were stopped. The easing of pressure allowed of necessary repairs, but shortage of labour and materials prevented rapid progress in this direction, although the general condition of working plant throughout the country was materially improved. Those of the newer designs of plant calculated to work with limited chamber space continued to give satisfaction, and instances are also noted in which a combination of the newer with the older type is in use, but as regards the latter it is considered open to question whether it is wise to combine two systems which differ in fundamental characteristics. It would seem that if the gas composition is adjusted to suit the small chamber space section of such a compound unit it will be too nitrous for the other section, and *vice versâ*, whilst an intermediate gas mixture is not calculated to elicit the best results from either section. The use of nitrous gases produced by the catalytic oxidation of ammonia continued to give much satisfaction, and the operation of this method was considerably extended; as experience is acquired, its facility of control and uniformity of operation are more recognised, and it is stated to be less costly than the old method, but it is pointed out that this aspect must depend on the relative cost of raw materials at the works. Oxide of iron contact towers, erected between the burners and the Glover tower, were under trial in several works, but did not give such good results as were anticipated, although in one instance such a tower led to a reduction by one-third of the nitre required to work the process. It is thought that the difficulties encountered are not fundamental, but that they are to be overcome by persevering effort. Trouble due to dust carried forward with the burner gases continued to receive much attention, and a modification of the usual chamber practice which has given satisfaction consists in removing part of the dust in depositing flues, and then cooling, washing, and filtering, and finally re-heating the purified gases before entering the Glover tower. This system entails more elaborate plant and increased fuel consumption, but is said to offer distinct advantages in yielding a high-grade acid and ensuring more regular working. Sulphide ores of zinc have proved satisfactory for use in the contact process and the calcined ore suitable for the extraction of zinc, but much difficulty has arisen in some cases in sufficiently purifying gases derived from the burning of pyrites, which has led to inefficient conversion of sulphur dioxide into sulphur trioxide and consequent high escape of acid gases, along with low production of "oleum." Gaillard towers continued in use for the concentration of sulphuric acid, but to a more limited extent, and these are still characterised by emitting the discharged waste gases higher in acidity than other types of plant. A modified form of Kessler concentrator did highly satisfactory work and the Davis concentrator proved efficient in bringing chamber acid up to about Glover tower strength. The Calder-Fox scrubber in its improved form is considered an efficient remover of suspended liquid particles. A man was fatally gassed by arsenuretted hydrogen whilst cleaning out a tank used for storing concentrated sulphuric acid, and attention is again called to the dangers of working in such tanks without proper ventilation both prior to anyone entering and also throughout the period of working, and to the necessity for taking precautions against the existence or formation of arsenuretted hydrogen.

Chemical Manure Works.—Greater activity characterised this industry; there was an increase both in the number of registered works and in their power of production. Indeed, in Scotland the quantity of phosphates and bones dissolved (76,800 tons) is the largest on record. The use of nitre cake is likely to become permanent as offering certain advantages apart from the question of producing superphosphates during a period of limited acid supply. The adoption of mechanical dens extended considerably, to the advantage of the industry, and many new types have been introduced.

Sulphate and Muriate of Ammonia and Gas Liquor Works.—Towards the close of the year there was a reversion towards the manufacture of sulphate of ammonia in several works where plant for production of concentrated ammoniacal liquor had been erected to meet the extensive but temporary demand for that product for munition purposes. The total quantity of ammonia products produced was less than in 1917 by the equivalent of 26,066 tons of sulphate of ammonia; thus, the first and the last year of the war were both associated with a reduced recovery of ammonia products. The shrinkage in 1918 was large when the expanding character of ammonia recovery for many years past is considered. Amongst influences tending towards a smaller production are mentioned the inferior quality of coal used, the use of water-gas, the large production of gas per ton of coal carbonised, the use of steam in vertical retorts, the production of concentrated ammoniacal liquor, accompanied too frequently by a high working loss of ammonia, and a reduction in the quantity of gas consumed. It is pointed out that a large production of gas per ton of coal carbonised and the use of steam in vertical retorts may lead to an increased recovery of ammonia per ton of coal, but that if the weight of coal used per volume of gas distributed is more than correspondingly less, an increased recovery per ton of coal carbonised is associated, on a similar gas consumption, with a decrease in the actual quantity recovered. In commenting on the foreign (largely German) control under which recovery coke-oven plant was erected before the war, it is observed that during the war important additions were made to works of this class by British effort and with British material, so that the future erection of such plant need not return under the former control. A fatal case of gassing occurred in a works where the proper procedure was not followed in attempting to remove a blockage in the exit pipe from the decomposer in a plant for producing concentrated ammoniacal liquor in a coke-oven works. Another fatality is reported from a sulphate of ammonia works where a female worker was gassed while endeavouring to replace a plug in a vent-hole in the pipe leading from the still to the saturator. Death in the second case was stated

to be due to carbonic acid poisoning, but it is thought probable that other gases were partly responsible. New installations of the "direct" process of sulphate making in gas works were put into operation during the year, but in two cases this process was discarded in favour of the ordinary distillation process, and in other works recovery by the direct process was disappointingly low. It is pointed out that it is only by careful attention to working conditions at the "bubbler," ammonia still, and gas purifiers that the best results can be obtained, and that where the process has been specially studied improved production has resulted. A memorandum on the analysis of ammoniacal liquor is attached as an appendix to the Report.

Nitric Acid Works.—There was a marked reduction in the output of nitric acid. An appreciable proportion was obtained from oxides of nitrogen resulting from the oxidation of ammonia and from the use of nitric acid in various processes. In most works, however, it was still manufactured by the decomposition of nitrate of soda, and for this purpose use was found for all the nitre-cake available.

Miscellaneous.—There was much activity in wool-carbonising works, and carbonising machines of improved type were brought into more extended use. Tinplate works were restricted in their operations by limited supplies both of labour and material. The use of nitre-cake for pickling the steel plates prior to tinning continued to be widely and successfully practised. The extent of operations was greatly reduced at alkali waste works, less waste being available for treatment in consequence of the increased production of alkali by electrolytic methods. The attractive prices for white arsenic led to the starting of several new works of this class, and, as in previous years, dry filters proved more efficient than wash towers for arresting arsenious oxide. There was active manufacture at bisulphide of carbon works, and in gas works the erection of tar dehydrating plant continued to extend, and there was also an increase in plant for the full distillation of tar. At picric acid works a great falling off in operations following the completion of the armistice is reported.

[Technical details contained in the Report will appear in the Abstracts.]

Report of the British Cellulose Inquiry Committee. [*Cmd.* 306, 3*d.*] (*London: H.M. Stationery Office.*)

The committee appointed by the Government in August 1918 to inquire into the formation and financial arrangements of the British Cellulose and Chemical Manufacturing Co., Ltd., and associated companies, and upon their relations to Government Departments, presented its report to Parliament a few days before the adjournment. Although the terms of reference did not, apparently, cover all the questions raised in the Fifth Report of the Select Committee on National Expenditure (this J., 1918, 300 R), most of the criticisms contained therein receive reference, if not full treatment. Speaking generally, it may be said that the effect of the Report is to exonerate all the parties concerned. The issue of the Report was delayed largely through the continued absence in America of Dr. Camille Dreyfus, one of the principal witnesses, "and the explanations which he has given to us seem to us very unsatisfactory." The history of the inception of the British Cellulose Co. and of its multifarious financial arrangements are described in considerable detail, and lists of shareholders and debenture-holders, with their holdings, are appended. The debentures were issued without Treasury sanction. The oral evidence and the accountants' reports, which are stated to accompany the Report, are not issued with it.

The original company formed to manufacture cellulose acetate and to acquire the Dreyfus British patent rights was promoted by a Canadian staff officer and two others "who had previously essayed without success the manufacture of cellulose acetate in this country." The share capital was £4000, divided into 6*d*. shares, of which approximately one-fourth ultimately went to the subscribers for debentures, 79,998 shares to the Swiss interests, and 41,079 shares to the promoters as their promotion profit. Two years later the second company—the British Cellulose and Chemical Manufacturing (Parent) Co., Ltd.—was formed, with a capital of £3,500,000 in £1 shares, shareholders in the original company receiving £14 10*s*. new shares for one old. Why 6*d*. shares should have been the denomination selected the Committee was unable to ascertain, but no evidence was obtained to show that the capitalisation of either company was used to procure undue influence or that such influence was obtained, nor could any material inference be drawn from the great contrast between the nominal amounts of the shares of either company and the prices at which they were dealt in. The original company's 6*d*. shares changed hands at prices ranging from £1 to £10 10*s*. per share. "The contrast between the nominal capital of the original company and that of the parent company is so glaring that, for much of the criticism to which they have been exposed, we think that the promoters and others connected with the company's financial arrangements have only themselves to thank."

The account of the relations between the companies and Government Departments is too lengthy to admit of a satisfactory summary, but the following points may be selected: The delay in the completion of the company's works at Spondon, near Derby, ceased after Government assistance was forthcoming in respect of granting priorities for materials, etc. The supply of cellulose acetate from France broke down in June 1917, and the ever-expanding aeronautical programme caused additional anxiety. Brig.-General W. Alexander, of H.M. Factory, Gretna, was then appointed Director of Supply, and Mr. J. Radcliffe head of the section dealing with "dope chemicals." The former investigated the possibility of manufacturing at Gretna a "nitro-dope" as an alternative to cellulose acetate. Nitro-dope manufacture is independent of the latter material, but, it is stated, its inflammability is greater. On the report of Mr. Radcliffe that the company had arranged to enlarge its plant to meet the increased programme, instructions were given to proceed with the work at Spondon, all necessary priorities were granted, and a loan of £200,000 was advanced on the power plant. The company started to erect works for the extended production of cellulose acetate, for an acetone plant and for a carbide factory, without waiting for formal sanction.

In November 1916 H.M. Treasury agreed to refund the company its capital expenditure on plant up to a maximum equivalent to the excess profits duty for which it would be liable, subject to the company agreeing to quote reasonable prices and to take orders only for Government purposes during the war. The Committee does not feel itself called upon to discuss this arrangement; and, moreover, while the concession was in force no profits at all were made. Nor does the Committee consider itself competent to pass any opinion on the quality of the company's cellulose acetate; the Technical and the Inspection Departments, however, give preference to the French product as being more uniform.

A considerable part of the inquiry related to complaints of the British chemical trade that prefer-

ence had been shown to foreign interests. The gist of the reply thereto is that the Government policy was to discourage duplication of plant, and that if contracts had been placed with new manufacturers much delay in obtaining deliveries would have resulted.

With regard to the complaint that the Government was made exclusively dependent upon one source of supply, the production from which had been previously criticised, the Committee finds that no ill effect appears to have resulted from the policy adopted; it is also of the opinion that nothing amounting to favouritism to the Company was shown by the Aircraft Department. Attention is drawn to an arrangement whereby each of the managing directors, Drs. Camille and Henri Dreyfus, was allowed £4500 per annum for living and entertainment expenses, and to the chairman, Col. Grant Morden, £5000 for similar purposes; and to the fact that in 1917 Dr. C. Dreyfus had offered to employ a subordinate officer in the Aeronautical Inspection Department at an enhanced salary. "If all the facts," the Report concludes, "which we have sifted with so negative a result, had been available last year to the critics of the company and its proceedings, we think that their conclusions would, to say the least, have undergone large modification. It is satisfactory to be able to report that, in our opinion, there has been neither favouritism nor corruption, and that the official action taken has been throughout such as appeared to the Departments concerned the best that was open to them under the circumstances."

OFFICIAL TRADE INTELLIGENCE.

(*From the Board of Trade Journal for August 7, 14 and 21.*)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 73, Basinghall Street, London, E.C. 2, from firms, agents or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

Locality of Firm or Agent	Materials	Reference Number
Australia	Druggists' requisites	411
,,	Iron, steel, heavychemicals	412
,,	Drugs, dyes	*
British India	Druggists' requisites	360
,,	Scientific instruments	366
,,	Drugs, soap, stains, etc.	367
,,	Metals	369
,,	Dyes, antifriction metals, wall and floor tiles	370
,,	Drugs, glass, crockery	373
,,	Glass, milk food	418
British West Indies	China, earthenware, glass	318
	Pharmaceutical goods	320
,,	Fungicides, insecticides	321
,,	Chemicals, drugs, soap, druggists' requisites	375
,,	Laundry soap	433
Canada	Rubber	314
,,	Glass, china	377, 378, 379
,,	Chemicals, druggists'goods	420
,,	Plate glass for automobiles, etc.	†
Egypt	Chemicals, paints, perfumes	383

*. The Agent General for New South Wales, 28, Cockspur Street, S.W. 1.
† The Canadian Government Trade Commissioner, 73, Basinghall Street, E.C. 2.

Locality of Firm or Agent.	Materials	Reference Number.
South Africa	Petroleum	387
,,	Galvanised sheets	429
,,	Hides, leather, etc.	430
,,	Dyes, glass, pottery, paper	431
,,	Copper sulphate, caustic soda, saltpetre, linseed oil, grease	432
Austria (Trieste)	Fats, oils, oilseeds, resin, fertilisers, etc.	434
Belgium	Paint, varnish	335
,,	Iron, steel, pitch	435
,,	Steel, metals	437
,,	Cretonne paper, cardboard, glue	439
,,	Sulphuric acid, sodium sulphate, pitch, calcium chloride, china clay, aniline dyes, pulp. (Goods in demand.)	—
Bulgaria	Petroleum, drugs, soap	440
,,	Copper, tin, galvanised sheets, caustic soda, soap	443
Czecho-Slovakia	Steel	390
Denmark	Leather	450
,,	Preserved foods	453
France	Soap	339
,,	Chemicals	391
,,	Haematite, Cleveland pig iron, etc.	393
,,	Ipecacuanha root	395
Italy	Lubricating oils	‡
,,	Refractory brick, crucibles	461
Netherlands	Druggists' sundries	463
Poland	Leather, tanning materials	399
,,	Chemicals	342
,,	Iron, steel, rubber, ceramics, chemicals, soap	§
Russia	Metals	345
Scandinavia	Soda ash	400
Serbia	Tinplate, asbestos, machine oils, paraffin, ceresine	466
Spain	Chemicals	351
,,	Chemicals, iron, steel, tinplate	352
,,	Metals	467
,,	Fertilisers	468
Switzerland	High-speed steel, chrome and nickel steel, etc.	353
,,	Oils, varnish, paint, soap, perfumes	473
,,	Chemicals, rubber	475
,,	Galvanised sheets	477
,,	Chemicals, drugs, disinfectants, perfumery	482
United States	Rubber, oils, chemicals, ores, metals, cattle food	356
Cuba	Chemicals, drugs	495
Chile	Iron, steel, glass, chemicals, dyes	357
,,	Tanning materials	490
,,	Glass, china	493

‡ The Secretary, British Chamber of Commerce for Italy, Via Silvio Pellico, 12, Milan.
§ The Secretary, Polish Commercial and Financial Agency, Commission International de Ravitaillement, 88, Kingsway, W.C. 2.

TARIFF. CUSTOMS. EXCISE.

Australia.—Recent customs decisions affect potato flour and condensed milk.

Belgium.—Except in certain cases export licences are no longer required for goods in transit through Belgium.

Export licences are still necessary in the case of, *inter alia*, ammonia, aniline, bones, brass, brick, cement, colours, certain metals, fats, oils, glycerin, gums, hides, lime, manganese dioxide, mineral pitch, nitric acid, phosphates, plaster, potash, resins, rubber, certain sulphates and sulphides, sulphuric acid, tar, tallow, turpentine, varnish and window glass.

Canada.—The Order in Council requiring all goods imported from Belgium to be accompanied

by a certificate of origin and interest has been rescinded as from July 1.

Colombia.—An additional duty of 3 centavos per kilo. has been levied on foreign salt imported at Buenaventura and Tumaco with effect from June 5.

France and Algeria.—Further particulars of the application of the new customs duties are given in the *Bd. of Trade J.* of August 7.

The law for the modification of the customs *régime* of petroleum products came into force on August 5.

French Indo-China.—The regulations governing the import and sale of cocaine, morphine and similar drugs may be seen at the Department of Overseas Trade.

Italy.—Among the articles for which import licences will be required after August 1 are, alcohol and alcoholic beverages, essences and essential oils, fruit syrup, chocolate, copper sulphate, sulphites of soda potash and lime, acetone, soaps, perfumery, vegetable fibres, artificial silk, cement, many metals, sulphur, copra, linseed, horn, benzine, mineral oil, sugar, matches, oilseeds and condensed milk.

A list of articles the import of which is prohibited except when destined direct to State Departments or "consortia" for supplies is given in the *Bd. of Trade J.* of August 14.

Luxemburg.—The provisional customs tariff is set out in the *Bd. of Trade J.* of August 21.

Morocco.—Export licences are no longer required for certain seeds, oleaginous seeds, locust beans, gums, resins, hides, vegetable hair and crude wax.

Netherlands.—The prohibition of the export of peat litter and sulphuric acid has been withdrawn as from July 25.

Recent customs decisions affect amyl salicylate, "pertinax" paper and magnesium perhydrol.

New Zealand.—Among the articles that have recently been classified for customs tariff purposes are metal cylinders to hold liquefied gases, welding rods of steel or aluminium, and certain kinds of paper.

Poland.—A copy of the provisional customs tariff may be seen at the Department of Overseas Trade.

Rumania.—A tax of 20 per cent. *ad val.* has been imposed on all exports except oil.

South Africa.—It is proposed to amend the customs duties on alcoholic beverages, medicinal preparations, ammonia and certain salts, barium peroxide, some preparations of phosphoric acid, borax glass, oil seeds and nuts, etc.

Southern Rhodesia.—The present customs and excise duties are to remain in force until July 31, 1920.

It is prohibited to import bones, bone meal, bone flour, bone dust, bone compound, dissolved bones or the like unless the bones have been sterilised by one of two processes mentioned. A declaration to this effect must be furnished by the importer.

Switzerland.—Export licences are no longer required for cork, artificial silk, lime, clay, sheets of imitation gold and silver, ammoniacal liquor, pure nitrate and Chilean nitre, etc.

Certain goods, amongst which are some chemicals, may only be exported over the Italo-Swiss and Franco-Swiss frontiers.

United States.—Recent rulings of the War Trade Board affect sugar, pig tin, tin oxides, alloys of tin, type metals, salvarsan and all substitutes and equivalents thereof, dyes, drugs, potash and chemicals.

COMPANY NEWS.

FANTI CONSOLIDATED MINES, LTD.

The ordinary general meeting was held in London on August 6, Mr. Edmund Davis (joint managing director) presiding.

After reviewing the financial situation, Mr. Davis described the developments which had taken place in connexion with the company's manganese deposits at Dagwin, near Taquah, in West Africa (this J., 1918, 57 R, 458 R). Shipments of ore during 1918 were 29,124 tons, and for the first six months of 1919, 14,907 tons. The concessions are, however, capable of being exploited to a far larger extent, one property alone, the Dagwin Extension, which has been proved along 2¾ miles, and upon which developments are being actively carried out, being capable of producing 90,000 tons a year. The detrital ore lying on the surface and down to a shallow depth is estimated to amount to nearly 3,000,000 tons. A large tonnage of ore has been sold over a term of years, the only outstanding difficulty being the high railway rate (8*s.* 6*d.* per ton, plus lighterage at Seccondee). Arrangements have been practically completed for the sale of the major part of the company's manganese interests to a new company with a share capital of £630,000, of which £50,000 will be subscribed for by a firm in the United States, which will also contract for 100,000 tons of ore per annum for five years. Steps are being taken to place the ocean transport of the ore in the hands of British shipping companies. As the United States has practically ceased to import ferro-manganese from Great Britain, it will probably need to import from 200,000 to 250,000 tons of manganese ore yearly, and even more if the steel capacity of that country continues to rise as it has done of late years (50 per cent. above pre-war capacity, against 43 per cent. increase for this country).

The balance of profit obtained in 1918 was £72,365 on an issued share capital of £448,448 in 8*s.* shares, and a dividend of 10*d.* per share for the year has been paid.

SOUTH METROPOLITAN GAS CO.

At the ordinary half-yearly general meeting held on August 13, Dr. C. Carpenter, chairman, dealt principally with financial considerations, export restrictions, and the "Beilby" Report on Gas Standards (this J., 1919, 191 R).

After successfully supplying public and private needs in South London for nearly thirty years, and performing work of more national than local importance during the war, the Company found itself in the unenviable position of being compelled by law to limit its half-yearly dividend to 1½ per cent. less tax (six-elevenths of the pre-war dividend). Business had been quite satisfactory, especially in view of the drastic regulations laid down by the Fuel and Lighting Order. In spite of these and of an increase of 100 per cent. in the price of gas, sales of the latter had only diminished by 2½ per cent. The principle of the sliding scale had not broken down but its present mode of application had become obsolete. Temporary hardships during the war were inevitable, but the present restrictions on the exportation of one of the company's products were unjustifiable. There should be no difficulty in basing the grant of export licences to individual undertakings upon the difference between home requirements and total production, the intermediation of a "pool" or "trust" being both unnecessary and dangerous. As a result of the present regulations, the company was left with a stock of by-products valued at nearly £250,000.

Dr. Carpenter expressed himself as in general agreement with the recommendations of the "Beilby" report, the chief of which was that in regard to gas no rigid standard of quality, other than calorific power, should be applied. The company proposes to adopt the procedure laid down in this report.

It was to be hoped that no more would be heard of the nationalisation of the coal industry, but mining rights might well be transferred to the State and leased by it to statutory undertakings. Workers in and on the mines should be taken into partnership with the capitalist, and with him have a voice in the management.

NITRATE COMPANIES.

The records of the principal nitrate companies during 1918 are given in the following table (*South American J., Aug.* 2, 1919) :—

—	Production		Trading profits		Estimated profit per quintal		Div.	Inc. or Dec.
	1917	1918	1917	1918	1917	1918		
	quintals	quintals	£	£	*d.*	*d.*	%	%
Aguas Blancas	767,000	726,000	65,413	56,924	14	19	10	$-3\frac{1}{2}$
Alianza	2,993,857	2,010,798	389,489	467,213	31	55	40	...
Angela	427,777	372,220	34,912	49,069	19	31	30	+5
Anglo-Chilean	2,589,650	2,275,700	435,719	169,494	...	...	15	−10
Fortuna	1,409,668	1,165,613	11,457	61,492	2	13	$7\frac{1}{2}$	$+7\frac{1}{2}$
Lagunas Nitrate	518,000*	494,000*	60,625	40,653	28	20	2	...
Lautaro	2,287,000*	2,000,000*	333,010	317,064	34	38	18	−6
New Paccha	527,100	535,000	14,634	29,809	6	13	10	−5
Salar del Carmen...	616,180	676,081	63,356	82,812	14	28	20	−15
San Lorenzo	349,000*	303,000*	16,903	23,192	12	18	25	...
San Patricio	217,000*	285,000*	7,180†	10,874	...	9	nil	...
Santa Rita	431,000*	430,000*	9,902	12,372	5	7	5	+5
San Sebastian	366,929	289,254	10,419	12,935	7	10	nil	...
Tarapaca	660,000*	674,000*	75,470	81,675	27	29	10	−5
Total	14,160,161	12,236,666	1,514,129	1,415,578	25	27	...	...

* Estimated. † Loss.

Although dividends have been reduced—by an average of about $3\frac{1}{2}$ per cent.—profits per quintal have been greater on a smaller output. The excellent price obtained of 13*s.* per quintal more than neutralised the increase in production costs in the case of the cheap producers. Since the cessation of hostilities the outlook has been darkening, and the situation will not improve until shipping facilities become available. Even then the market must to some extent be restricted owing to high freights, although the demand for agricultural purposes will be great. Owing to these circumstances the production of synthetic nitrogenous fertilisers is likely to be stimulated, and countries like Germany which possess a developed nitrogen industry will be in a strong position. It is the considered opinion of a chemist, of more than national repute, who has recently inspected the great Haber plants in Germany, that synthetic nitrate will be able to compete with Chilean nitrate at no very distant date. At the present time the German chemical industry as a whole is in a state of suspended animation owing to the dearth of coal.

BRITISH GLASS INDUSTRIES, LTD.

At an extraordinary general meeting held on August 7, Mr. C. W. Milne, the chairman, said the object of the meeting was to obtain authority to increase the company's capital by a further £750,000, and to issue 300,000 new £1 shares at 30*s.* premium. The whole of the shares of the Queenborough Glass Bottle Works, Ltd., and the business of the British and Foreign Bottle Co. have been acquired; and also 300,000 8 per cent. cumulative participating preference shares in the British Window Glass Co., Ltd., whose recent issue was over-subscribed six or seven times. At the company's factory at Canning Town, furnaces with a weekly capacity of 100—120 tons each are being installed; one of them is complete, five are nearing completion, and there are practically another ten in course of erection. There are four furnaces in active operation at the Queenborough works and two additional furnaces ready to start. In addition to the automatic glass bottle-making machines, the company has acquired the sole rights for machines for automatic grinding of stoppers and bottles. An output of 1750 tons per week is anticipated for the factory at Canning Town, where eventually only coloured bottles will be made, the manufacture of the pure white bottles being confined to the Queenborough works. The resolution to increase the capital was passed unanimously.

REVIEWS.

THE CHEMISTS' YEAR BOOK. *Edited by* F. W. ATACK, *assisted by* L. WHINYATES. *Fourth edition,* 2 *vols. Pp.* 1146. (*Manchester: Sherratt and Hughes,* 1918—19.) *Price* 15*s.* 6*d. net, post free.*

The first edition of the Chemists' Year Book, published at a time when the supply of the well-known German publications of similar scope had ceased, bore signs of hasty preparation, but met a distinct want and secured a considerable circulation. With successive editions the scope and value of the book have increased, and the present edition, though still capable of considerable improvement, is a very useful and on the whole trustworthy work of reference. One of the most commendable features of the Year Book is that the Editor is depending more and more for his material on authorities in the different branches of the subject. New sections have been provided by Dr. J. W. Mellor on "Analysis of Clays, Firebricks and Silica Materials"; Dr. E. J. Russell on "Agricultural Chemistry"; Dr. E. H. Rodd on "Crystallography," and others. Many sections

have been revised including the organic section which is greatly improved. Among the useful contributions to this part of the subject may be mentioned that of Dr. E. Hope on alkaloids.

The scope of the work has been referred to in former reviews, and need not be described in detail. The number of topics touched on is now so great as to raise a doubt whether the Editor is not attempting too much. He will be well advised to devote attention to the improvement of the present sections rather than to further extension of the scope of the book. In this connexion the sections with a physico-chemical bearing deserve special mention. The quotation (p. 436) of the densities of certain alloys to three places of decimals without mention of the temperature is absurd. In many of the solubility tables old and incorrect figures are given and as regards aqueous solutions the composition of the solid (hydrate or anhydrous salt) in equilibrium with the solution is not clearly stated. In these and some other sections much labour must be expended in order to make them an accurate reflexion of the present state of our knowledge, and the revision must be thoroughly done if the work is to hold its own with the German publications which will soon be available.

George Senter.

Organic Chemistry or Chemistry of the Carbon Compounds. *By* Victor von Richter *(Edited by Prof. R. Anschütz and Prof. G. Schroeter). Volume I.* Chemistry of the Aliphatic Series. *Newly translated and revised from the German Edition (after Prof. F. Smith's third American Edition) by* Percy E. Spielmann. *Second (Revised) Edition. Pp. viii + 719. (London: Kegan Paul, Trench, Trübner and Co., Ltd.,* 1919.) *Price 25s. net.*

Even in these days of specialisation there is doubtless a certain number of people who obtain their knowledge of some particular science by studying an orthodox text-book, but there are probably few who would attempt to obtain a knowledge of advanced organic chemistry in this way, and who would not, in the ordinary course, attend lectures on the subject in one or other of the many recognised institutions. The books required may, therefore, be regarded as being supplementary to the lectures and can be placed in three classes: (*a*) the elementary text-book, (*b*) the advanced handbook, and (*c*) the research and reference literature.

We are well supplied with a number of excellent text-books which fall within class (*a*) and there is little need for criticism in connexion with them, unless, indeed, it were that their number embarrasses choice; regarding (*b*) and (*c*), however, the conditions are quite different.

It will be recognised by every teacher of advanced organic chemistry that a handbook of some kind is essential, because it is impossible in an ordinary course of advanced lectures to deal with any but the more important details, and the lecturer must confine himself mainly to the treatment of particular groups of compounds and make his points chiefly by the comparison of one group with another. In other words a course of advanced lectures in organic chemistry cannot, strictly speaking, be systematic, and the student must necessarily rely on his handbook for his knowledge of the system of the science and for the filling in of gaps.

There are, then, two essential features of the ideal handbook, namely, that it should be systematic and should give without excessive detail the main principles underlying each subdivision of the science. For these reasons those handbooks which are merely a collection of lecture notes, although valuable as representing another point of view, do not supply the want, as it is understood by the present writer, since they suffer under the same disadvantages as the lectures themselves.

Two outstanding attempts have been made to meet the need outlined above—both are German. One was initiated by the late Victor Meyer but left incomplete at his death. It was finished at a later date by Jacobson, and few organic chemists will deny that this treatise, which has never been translated, represents in many ways the ideal method of treatment. The other is V. v. Richter's handbook, a translation of the first volume of which, from the eleventh German edition, has now appeared.

Now, although opinions may differ as to the desirability or otherwise of having books of class (*c*), that is research and reference literature, written by our own people and in our own language, there can hardly be two opinions, apart from any question of the method of treatment, as to the undesirability of having handbooks of class (*b*) translated from other languages. A brief consideration of the book under review will clearly show one reason for this, because, owing doubtless to the complexity of the subject, the first volume of this edition was published at Bonn in 1909, whereas the second volume of the same edition did not appear until 1913. When one contemplates the amount of literature which has passed through the different publishing bodies since this first volume was written, it is clear that a handbook published at that time cannot be now up-to-date. It is true that the translated edition in the present instance is described as revised, but if this revision means correction of the text in accordance with recent discoveries, its effect has been negligible; indeed, the chemistry of this book is the organic chemistry of 1909, that is to say the book is ten years out of date.

Again, there is another great objection to the use of a translation, because it is apt to give a false sense of perspective to the advanced student. This objection is, moreover, enhanced in the present instance, because the Germans have, for a long time past, constituted themselves the recorders and publishers of organic chemical literature, a position which they have often abused by their policy of giving prominence to their own discoveries and deliberately leaving out, wherever possible, all reference to the discoveries made in other countries. It is greatly to be regretted, therefore, that the translator should have retained the original German references in their entirety, because a student reading this book could hardly fail to arrive at the conclusion that organic chemistry was a German science and that the discoveries made by other nationalities were negligible.

Every student of advanced organic chemistry knows "Richter," and probably every student realises, sooner or later, its limitations. The writer can well remember the effect produced on him by his first perusal of it in 1891, and the opinion formed by him then has not changed since. The greater portion of the book is wasted by the inclusion of too much detail which could easily have been placed in tabular form, if indeed it is necessary to include it at all, since such details are mainly of interest to research students and are given in full in the research and reference literature. On the other hand the main principles of the science, represented by the larger type, are given in too fragmentary a manner and a great deal that is essential is omitted.

This criticism is written in no carping spirit, but chiefly in the hope that the right handbook on organic chemistry will be taken in hand ere long. For the present we have nothing but "Richter" and must perforce put up with its many imperfections.

J. F. Thorpe.

OBITUARY.

EMIL FISCHER.

The death of Emil Fischer deprives organic chemistry of its greatest leader. We, his contemporaries, can hardly estimate the place his work will take in the future, but it is probable that he will be regarded as one of the greatest organic chemists. Fischer was essentially a worker, he lived for nothing else and, though to work under him was the finest inspiration a young man could have, his pupils in the main have gone into industry. Fischer never founded a school in the sense that Von Bayer has done at Munich and he has not been responsible for any great new theories. His work was typically German, of the very best type, painstaking and thorough to the last degree. As a manipulator he was one of the best in the days when the standard of perfection was far higher than it is to-day, and though of later years he only very occasionally performed experiments himself his powers of observation and criticism remained unimpaired. His personality will remain in the memory of all who met him: tall and handsome in appearance, his voice had a singular charm. His tastes were of the simplest and his life a very retired and regular one solely devoted to his work. He systematically overworked, and regarded himself as more or less an invalid owing to phenylhydrazine poisoning. With his German students he was inclined to be autocratic, but treated the many foreigners who worked under him in a most friendly manner, particularly the English to whom he was very partial.

Fischer was born at Euskirchen in the Rhine province on October 9, 1852, and was nearly 67 when he died. He avoided official functions as much as possible and took but little part in chemical politics. A keen critic himself he was somewhat intolerant of criticism of his own work.

His influence on German chemical industry was very great. He frequently had some technical work in hand though this was always made subordinate to the academic research work. He placed his men in good positions in industry without difficulty, and many of them have since done well. Naturally he attracted the pick of the students from all countries and therefore was particularly fortunate in his collaborators: hence also the "atmosphere" of his laboratory was most enthusiastic and fertile of ideas.

He was a brilliant lecturer, though in later years he lectured to the first year students only: in the weekly colloquium attended by the research staff and students he was at his best as a teacher.

Fischer took his degree at Strassburg in 1874, and eight years later became ordinary professor at Erlangen, moving to Würzburg in 1885 and to Berlin, where he followed Hofmann, in 1892. The old laboratory in the Dorotheenstrasse was quite inadequate, and in 1900 a move was made to the new quarters in the Hannoverstrasse, where every conceivable facility was available and where he began his investigation of the proteins.

Fischer's researches were in the main in connexion with the three groups of natural products: the sugars, the proteins and the purines; he has reprinted his papers in three volumes so that they are easily accessible to the student.

The purine work dates from 1882 and was summarised in 1899—in its course the complex formulæ of uric acid, xanthine, guanine, etc. were established and their synthesis effected. The behaviour of the parent substance of the group, purine, and its derivatives was fully established, and technical methods for the synthesis of many of them have been subsequently elaborated.

Fischer's real love was for the sugars and he continued to work in this field until his death. His ultimate aim, the synthesis of cane sugar, was never realised, though he achieved the first synthesis of a natural disaccharide—melibiose. Probably no other field of work has been so difficult experimentally, and his papers on the synthesis, and still more the proof of the structural and stereochemical formulæ of glucose and its isomerides, are among the classics of chemical literature. In the simplest of language he develops a story which will have power to enthrall the student for many years to come. His talisman proved to be phenylhydrazine, and the first paper describing the interaction of this with the sugars bears the date 1884.

The protein work was begun in the new laboratory in Berlin: it involved first the study of the amino acids, then the application of the knowledge so gained to the analytical study of the products of hydrolysis of the proteins, and finally the coupling of the various amino acids to polypeptides approaching the proteins in complexity.

E. F. Armstrong.

PUBLICATIONS RECEIVED.

Boiler Feed Water. A Concise Handbook of Water for Boiler Feeding Purposes. (*Its Effects, Treatment, and Analysis.*) *By* P. G. Jackson. *Pp.* 102. (*London: Charles Griffin and Co., Ltd.* 1919.) *Price* 4s. 6d.

Report on Trade Conditions in British East Africa, Uganda and Zanzibar. *Union of South Africa. Department of Mines and Industries. By* T. Sleith. *Pp.* 64. (*Cape Town: Cape Times, Ltd.* 1919.)

Recherches sur Differents Points de la Fabrication des Obus. *By* L. Guillet. *Pp.* 34. (*Paris: La Revue de Métallurgie.* 1917.)

Publications of the United States Bureau of Mines. *Department of the Interior.* (*Washington: Government Printing Office.* 1919.)

A Preliminary Report on the Mining Districts of Idaho. *By* T. Varley, C. A. Wright, E. K. Soper, *and* D. C. Livingston. *Bulletin* 166. *Pp.* 113. *Price* 20 *cents.*

Combustion and Flue Gas Analysis. *Reprint of Engineering Bulletin No.* 4. *Prepared by the United States Fuel Administration in Collaboration with the Bureau of Mines. Technical Paper* 219. *Price* 5 *cents.*

Saving Steam in Industrial Heating Systems. *Reprint of Engineering Bulletin No.* 6. *Prepared by the United States Fuel Administration in Collaboration with the Bureau of Mines. Technical Paper* 221. *Price* 5 *cents.*

Boiler Water Treatment. *Reprint of Engineering Bulletin No.* 3. *Prepared by the United States Fuel Administration in Collaboration with the Bureau of Mines. Technical Paper* 218. *Price* 5 *cents.*

Combustion Experiments with North Dakota Lignites. *Technical Paper* 207. *By* H. Kreisinger, C. E. Augustine, *and* W. C. Harbster. *Pp.* 44. *Price* 10 *cents.*

Publications of the United States Geological Survey. *Department of the Interior.* (*Washington: Government Printing Office.* 1919.)

Stone in 1917. *By* G. F. Loughlin *and* A. T. Coons.

Mineral Production of the United States in 1916. *Introduction by* H. D. McCaskey. *Summary by* M. B. Clark.

THE PATENTS AND DESIGNS BILL, 1919.

I. From the Point of View of the Chemical Manufacturer.

ROBERT L. MOND.

The manufacturer stands in a complex relation to patents. He is the principal user of them. As such he acquires those of use to him and owing to the continuous survey of the problems he encounters, and the researches necessary to elucidate them, he himself becomes an inventor and where possible covers his inventions with his own patents. As a patent is a monopoly granted for a limited number of years, in certain cases he desires for his own protection to benefit by this monopoly; in other cases he feels himself hampered by it.

New inventions covered by patents are rarely sufficiently worked out to enable a manufacturer to apply them without considerable further research and expenditure of capital, and many inventions —especially those affecting the large fundamental [illegible]rocesses—require large means and many years to [illegible]sh them on a fully commercial basis.

[illegible] propositions contain an element of self-[illegible] follows that any patent law must be [illegible] compromise, and the new Patent[illegible]iticised from this point of view.

The first para[illegible] attempts to solve the difficulty created by the monopoly value of a patent in so far as it restricts manufacturing in this country, and the machinery adopted is to give very wide powers to the Comptroller of Patents which in certain cases he can delegate to an arbitrator, subject to an appeal to the High Court of Justice. It may be assumed that in all important cases such an appeal would be made, and the question arises whether a special Court with suitable assessors would not prove a more satisfactory tribunal than putting this additional duty on to the back of an already overburdened official.

Compulsory working of patents has been an essential part of the patent laws of most countries, and up to now has invariably proved a dead letter. One of the principal reasons for this is that without cordial co-operation between the inventor and the manufacturer it is only rarely that the printed description of a patent—however carefully drawn—conveys sufficient information to enable a new process to be successfully worked, and this successful co-operation cannot be obtained by compulsion. As a matter of fact a patent is only granted for a demonstrably new idea, whereas some of the fundamental conditions which allow this new idea to fructify may not in themselves be patentable and consequently are automatically excluded.

Paragraph 2 enables a patentee to make the Comptroller the business agent for the disposal of his patent on terms which the Comptroller will settle. Whether many patentees will avail themselves of this privilege will remain to be seen.

Paragraph 4, limiting the right of research to "any complete specification or any provisional specification followed by a complete specification" published during the last fifty years, treads on dangerous ground. Anyone conversant with the patent literature of 50 years ago will be struck by the number of valuable inventions which were then made and which might be re-patented as novelties to-day under this clause. The confinement of research within these narrow limits also gravely restricts the rights of the public to the benefit of former achievements of the human mind. As similar restrictions do not exist in other countries the search made by our patent office is placed on a much inferior level to that in other countries, and the fact that a patent is granted in this country would be no guide to its prospects of being accepted elsewhere.

Paragraph 6. The proper length of life of a patent has been the subject of various practice and much discussion. The United States, by including the two years provisional term, gives an effective life of 19 years. Ours used to be 14. This is now raised to 16.

The profound dislocation of industry due to the many new requirements arising from the war has in many cases not only prevented the full benefit being obtained from expiring patents but has precluded the full development of new patents not directly connected with war work. The claim of many inventors that existing patents or those which have expired during this period should be automatically prolonged for a term equal to the duration of the war, must commend itself to our sense of justice, especially as patent fees have been demanded during this period. At the same time new industries may have been started partly based on the assumption of the pre-existing normal life of a patent. The proposed term of sixteen years is of the nature of a compromise. It would have been fairer to have prolonged the life of patents for the whole period with provision for the grant of free licences to the above-mentioned industries. The inventors have been partially recompensed by additional dues being demanded for the two years. It is also provided (paragraph 7) that a patent may be prolonged from five to ten years by an appeal to the Court. This provision has always been a constituent part of English Patent Law, but the machinery has been so cumbersome and expensive and the decisions so erratic that very few have availed themselves of it. One of the greatest difficulties in judging the reasonable life of a patent lies in the fact that some inventions can be applied and tested with very little expenditure and effort in the course of a few hours, while others require very large means and many years of strenuous endeavour for their useful application. As a matter of fact it may be considered doubtful whether any of the inventions which have revolutionised great processes have been sufficiently advanced to allow of adequate working during the life of the original patent, and when the inventor has benefited it has been through subsequent patents obtained for improvements on the original idea.

Paragraph 9. The relief from the anomaly which made the validity of a patent depend on the validity of each claim is a distinct improvement and will facilitate correct findings in actions for infringement.

Paragraph 11. This paragraph provides for exceptional treatment of inventions for a certain class of materials, *viz.*, chemical substances for use in food and medicine and which are on the borderline between patents and trade-marks. As a matter of principle it is inadvisable that inventions should be differentially treated. Whether the power given to the Comptroller and the Court to deal with these will prove an advantage or disadvantage to the public, time alone will show. In so far as this clause makes the process of production of a chemical substance and not the substance itself the subject matter of a patent, it is a distinct improvement, and the inventor is safeguarded by the presumption of infringement by other producers who cannot demonstrate an alternative method of production.

II. From the Standpoint of the Chartered Patent Agent.

A. G. BLOXAM.

This new edition of the Bill that was before Parliament in the fall of 1917 stirs the present writer with melancholy. Two of the small committee who invented the Bill have already passed away. Splendid lawyers, both; but there is some doubt whether this, almost their expiring effort, may not come to be regarded as one of those deeds which live after men rather than as something worthy to have been interred with their bones.

There must be a reason why, for fifty years past, the manufacture of dyestuffs has been the Chemical Industry in the public mind. Possibly the cause is to be found on the north side of Oxford Street (curiously, there are no drapers on the south side); another case of *cherchez la femme*. Whatever the cause, no public pronouncement by politician, professor or patent agent has dealt with the chemical industry of this country as other than a struggling competitor of Germany's speciality.

Yet there is not much exaggeration in the remark that a maker of alkali made to the present writer—that the dyestuff industry is little more than the crumbs that have fallen from our table.

So long as the public interest in chemistry was aroused at all, it seemed of little importance in what particular branch of the science interest was awakened. When, however, agitation initiated by this particular section of the industry ends in a Bill of so remarkable a character as that now before us, the matter assumes a more important aspect.

The provisions of the Bill dealing with "abuse of monopoly rights" remain almost identical with those of the previous measure of 1917 (this J., 1918, 2 R).

The proper policy for the patent agent is, no doubt, to sit tight and say nothing; for if ever there were any truth in the popular belief that Acts of Parliament are drafted *by* lawyers *for* lawyers, that truth is illustrated here. Particularly should he let the matter rest, seeing that the patent agent—who had begun to think himself a patient agent—has at length received some further acknowledgment that he is a help, not a hindrance; indeed, in the new edition the inventor's pilot is to share with the sailor's pilot the honour of being the only professional man who must be a British subject.

But does the industry realise that the Bill enables any person interested to start an inquiry as to what particular process is being used in the works, and to what extent—whether patent A or patent B has proved the more profitable? Nor is such an inquiry to be conducted merely as between the patentee and the person interested, since any other person may take a hand in the game when it has once been started and must, of course, have access to all the evidence. If competition for trade is to be at an end this matters little; and so does a patent law.

The clauses relating to "licences of right" also remain with little alteration. One would like to learn the *motif* of these provisions; by accepting them the poor inventor will save in renewal fees, but become involved in certain legal formalities of which he may be heartily sick before he is quit of them. Will those desirous of using the patent be more eager to take a licence because the patent is endorsed? The patent agent's experience is that the patentee who is not himself a manufacturer is only too willing to negotiate the grant of a licence and is generally well satisfied with the result.

The term of the patent is to be increased by two years; on the other hand there is no moratorium for patents which have existed during the war.

The period of provisional protection is to be nine months instead of six. No one is likely to object to the additional three months for settling that curious jumble of technics, law and the word "substantially," called the complete specification.

It is to be regretted that the dyestuff industry should have prevailed in retaining the clause that prohibits claims for "substances prepared or produced by chemical processes." If we are to imitate the German law in the illogical manner in which it allows the mechanic to claim his product while forbidding the chemist, let us do so; but the words quoted have a meaning far more widely reaching than the prohibition of the German law. Why not acknowledge the real purport of the clause by limiting it to "dyestuffs and synthetic drugs"?

III. From the Viewpoint of the Inventor.

DOUGLAS LEECHMAN.

The granting of letters patent for inventions and the registration of new and original designs are based on a recognition of the fact that trade is benefited materially by the introduction of new and improved manufactures. The aim of any legislation on these subjects must therefore be regarded primarily and principally as to its effect on our industries; but, very much as there can be no eggs without hens, so there will be no inventions introduced unless our engineers and chemists are induced to become patentees and proprietors of registered designs. It will be useful, therefore, to consider how far the Patents and Designs Bill of 1919 would be likely, if it became an Act, to encourage or discourage inventors as such.

The Bill offers direct encouragement to inventors by extending the term of patents from fourteen to sixteen years from the date of application. Hitherto the possible life of a British patent has compared unfavourably with that of a number of other important countries, notably that of the United States of America where the term is seventeen years *from the date of grant*, and no renewal fees are demanded. While appreciating the additional two years, inventors must not be thought ungrateful if they continue to press for a term more equal to that enjoyed by our American cousins.

Another good proposal in the new Bill is found in Clause 8. It provides that if an alleged infringer is found to contravene any valid claim of the patent in question, the patentee shall be entitled to relief. This is much fairer than the present law, according to which if the defendant can upset any one claim in the specification he is held guiltless, even if he was never accused of infringing that claim.

Section 18 deals with patent agents, and by prescribing that any unauthorised person who either describes himself as a patent agent or practises as such, shall render himself liable to a penalty, will do much to protect the unwary inventor against unscrupulous and incompetent sharks.

An important improvement of the present law is hidden away among the schedule of minor amendments of the 1907 Act. It consists in a reversion to the old period of nine months for filing the complete specification, reckoning from the date of application with a provisional specification. Many important inventions cannot be worked out in the six months at present allowed for the purpose, and the extra three months will result in inventions being both more perfectly developed and more securely protected. The proposal to empower the Comptroller to proceed with a complete specification filed by one applicant only where the other turns obstructive, is another good practical idea.

Probably the promoters of the Bill would say that other clauses are very much to the advantage of the inventor, but I fear the contention only shows their lack of appreciation of the inventor's

position. Thus, Clause 2 offers to reduce to one-half the renewal fees on any patent if the patentee will agree to have it endorsed "licences of right." If an inventor is a manufacturer he will not want to license anybody and the half price renewals will be no sort of temptation to him; if he is not a manufacturer, licensing is practically the only way he can make money by his patent and he does not need the inducement offered. And no patentee in his senses is going to grant licences, where every licensee is to have the right to force him into an action for infringement, which is one of the preposterous provisions of both Clauses 1 and 2.

Clause 7 is good in so far as it gives the Court a general discretion to extend the period within which a petition for prolongation of a patent may be presented; but the provision for loss and damage to patentees by reason of the war is hopelessly inadequate; while proposed reduction of the term for which patents may be prolonged is, of course, distinctly prejudicial to inventors.

Clause 11, which deals with chemical products and substances intended for food or medicine, deserves more attention and space than can be given to it in a general article such as this; but it may be said that this clause is less objectionable than the corresponding one in the Bill of 1917. It is still far too wide in that the first part extends to all substances produced or prepared by chemical processes, not being confined to foods and medicines, and the second part is aimed against any invention *capable of* being used for the preparation or production of food or medicine. Licences are still to be granted to practically anybody and at a minimum of recompense to the patentee, though the fact is expressed a little less brutally than before. When will the authorities learn that the best inventors are still human beings and will not invent, and patent, and exploit for the fun of the thing (if any)?

The provisions for extending the grounds of opposition to prior publication in any document in the United Kingdom, and for disclosing the results of the official searches, though not directly favouring inventors, are so excellent on general grounds that one can hardly object to them as prejudicial to the interests of inventors.

The Bill seeks still further to negative the present enactment that a patent shall have to all intents the like effect against H.M. the King as it has against a subject. Perhaps the idea is to give a colour of regularisation to some of the acts committed in the name of the Crown during the war. These matters should be settled entirely by the Courts and so be cleared of any savour of suspicion and discredit.

It is deeply to be regretted that the Bill contains no provision for restoring to patentees the period of protection which they have lost during the war. They have complied with every requirement of the Acts and Rules and have even in many cases continued to pay renewal fees, and there has been a wholesale failure on the part of the Crown to carry out its part of the bargain. This is a gross injustice to patentees, and worse, it is a gross injury to the industries of the country which are being deprived of the use of many hundreds of inventions of proved commercial value.

It is also to be deplored that the other recommendations of the Federation of British Industries and the Conference of Technical Societies, especially in the matter of renewal fees, have been so studiously ignored by those responsible for the contents of the Bill. Fortunately the House of Lords was apprised of the true position and refused to be rushed into passing the Bill before the recess and will subject it to close scrutiny and criticism when it is brought up in the autumn.

PERMEABILITY OF CONCRETE.

S. BOWMAN.

The following notes describe in outline a method of investigating :—

1. The comparative merits of various concrete waterproofing agents.

2. The effect of such compounds on the chemical and physical properties of Portland cement and reinforced concrete.

3. The economic aspect of the use of such compounds.

Concrete waterproofing compounds are sold under various trade names and in most cases are patented proprietary articles. They may be divided into two classes :—(1) integral compounds, *i.e.* those that are intimately mixed with the Portland cement, and (2) compounds to be applied externally to the finished surface of the hardened concrete. Both classes may be further divided according as their action is chemical, *i.e.* those entering into chemical combination with the constituents of Portland cement, or physical, such as water repellents.

In order that an examination of the utility and effect of such compounds may be made, it is desirable that exhaustive tests be carried out with various Portland cement mixtures treated with the respective compounds and that the method of treatment be strictly in accordance with the instructions issued by the vendors of such articles.

With these objects in view, the following tests are to be recommended :—(*a*) Porosity, (*b*) tensile strength, (*c*) compressive strength, (*d*) setting time and soundness, (*e*) chemical constitution, (*f*) corrosion of reinforcement, (*g*) adhesion of reinforcement, and for purposes of comparison, it is necessary that the same cement and sand should be used throughout the various tests.

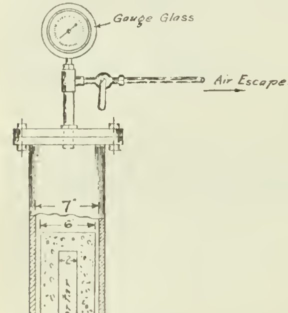
(*a*) *Porosity.*—In determining the porosity or permeability of a material like concrete it is desirable that the conditions of the test adopted should resemble as far as possible those obtaining in actual practice in the field. On reviewing the various methods of testing porosity it is considered that some form of percolation test is to be preferred to an absorption test as the latter has been found to give no criterion of the resistance of a material like concrete to the percolation of a liquid under pressure. Further, in connexion with a percolation test, it is considered that the usual disc form of test specimen is not satisfactory owing to the small area —at the most a few square inches—which can be exposed to liquid under pressure on account of the comparative weakness of the material. If, however, a test specimen be made in the form of a hollow cylinder closed at one end, a vessel is obtained having a large surface area and being cast in a mould is free from that skin surface unavoidable where a hand tool such as a trowel is used.

Such vessels may be conveniently made by filling a cylindrical mould (made in two sections and bolted together), say 24 in. in depth and 6 in. internal diameter, with the cement mixture and embedding a round bar of 2 in. diameter to the required depth of 22 in. by means of a central guide. After the material has set and allowed to harden for a short time it is possible to remove the mould and bar and a vessel is obtained with walls 2 in. thickness and a superficial area of 480 sq. in. A series of such vessels may be made for each waterproofing agent, the proportion of cement to sand varying from 1 : 1 to 1 : 5 in each series, and also a similar series of vessels composed of the same cement mortar without waterproofing treatment.

The mixing of the mortar should be carried out with shovels on a non-absorbent surface for a definite period of time and with a definite percentage of water for each strength of mix.

After removal of the mould the vessels are completely immersed in water and allowed to mature for a period of, say, 21 days in order to accelerate the hardening of the mass, after which they are allowed to dry out in air before being fitted into the testing apparatus, the age of each vessel being similar.

The apparatus for testing such vessels (see sketch) consists essentially of a convenient length of C.I. piping with an internal diameter slightly greater than that of the vessel, say 7 in., the upper



APPARATUS FOR TESTING POROSITY OF CYLINDERS.

end being closed with a blank flange and the lower end with a circular base plate to which the vessel is fitted. The latter is made with a circular groove $2\frac{1}{2}$ in. wide and 1 in. deep, and a small central hole into which the drip pipe is screwed.

A satisfactory method of fixing the vessel is to warm the base plate and half fill the groove with melted pitch, into which the open end of the vessel is carefully lowered. The surplus pitch overflows and with the aid of a hot poker a perfectly tight joint is finished off. When cool, the base plate with fitted vessel is securely bolted to the bottom flange of C.I. pipe, rubber washers being used to obtain a tight joint.

A side pipe is connected to the water pump and the apparatus filled up until the gauge shows 50 lb. pressure per sq. in. To test the permeability of the vessel this pressure is maintained until the amount of water percolating through the walls remains constant for any period, say 1 hour, at which stage readings are taken every hour for 6 hours, and the average taken to represent the permeability at this pressure.

Following this the pressure may be increased in gradual stages to 100 to 200 lb. per sq. in., allowing in each stage a time until constancy of percolation is obtained before taking readings as before.

In the event of there being no signs of percolation at the lower pressure after, say, 6 hours, the pressure may be raised to higher stages for similar periods, and if no percolation takes place at 200 lb. during a period of 48 hours the vessel may be said to be reasonably impermeable for the purpose of this test. In this manner all the vessels of each series may be tested, and the amount of percolation plotted against the percentage of cement in each mixture will give a curve showing the resistance of varying mixtures to percolation at various pressures, with and without waterproofing treatment.

Similarly, if desired, this test could be carried out using fuel oil or other mineral oil instead of water.

(*b*) *Tensile strength.*—In order to ascertain the effect of waterproofing compounds on the tensile strength of Portland cement, a series of briquettes should be made under B.S.S. conditions, composed of neat cement and also a mixture of standard sand and cement in the proportions of 3 : 1. Each series to be treated with a waterproofing compound under examination in addition to a series made without treatment.

Further in connexion with this test it would be desirable to ascertain the relationship of strength to age, therefore each series should consist of briquettes to be tested after maturing in water for periods of 7, 14, 28, 56, 90, 180, 365 days, the average breaking strains of 6 neats and 6 sands to represent the strength of each of these periods.

The results in lb. per sq. in. may then be plotted against the age and a curve obtained showing the effect in each particular case as compared with untreated cement.

(*c*) *Compressive strength.*—In this test 3 in. cubes composed of standard sand and cement in proportions of 3 : 1 and treated as in the previous test, should be made and crushed to destruction after maturing in water for similar periods. The results in lb. per sq. in., representing the average of 6 cubes at each period, could similarly be plotted showing the effect of such compounds on the compressive strength of Portland cement mortar at various ages.

(*d*) *Setting time and soundness.*—With regard to those waterproofing compounds which require mixing with the cement before use, it would be desirable to ascertain their effect on the original setting time and soundness of the cement used.

For these tests a quantity of cement, intimately mixed with the compound, should be spread out in a layer of 3 in. thickness and allowed to aerate for periods similar to those in test (*b*). At each period the whole should be thoroughly mixed up and a quantity withdrawn for the determination of setting time and soundness on the lines laid down in the B.S.S.

(*e*) *Chemical constitution.*—A complete analysis

of each waterproofing compound should be made in order as far as possible to determine its constitution, its probable action having regard to the constituents of Portland cement, and also the possibility of the equilibrium of the latter being so disturbed as to threaten disintegration.

(*f*) *Corrosion of reinforcement.*—The object of this test is to determine whether the rusting of steel embedded in cement mortar treated with integral waterproofing compounds is more or less rapid than when embedded in an untreated mortar of similar proportions.

For this purpose a series of cylindrical blocks 6 in. × 3 in. of 3 : 1 sand and cement may be made in suitable moulds and, while still in a plastic state, each block to have a ⅜ in. round mild steel rod of known weight partially embedded along the axis of the block in such a manner that that part of the rod is protected with an equal thickness of mortar. After maturing for a period of, say, 14 days in water and 7 days in air, the blocks are placed in a bath of sea water so that the surface of the water is 1 in. below the top of each block.

In order to accelerate corrosion the projecting ends of the rods are connected up in parallel to the positive plate of a 4 volt cell, the cathode being a sheet iron plate placed equidistant from all the blocks.

After remaining, say, 28 days under these conditions the blocks may be broken and the rods extracted. These are immediately immersed together for 1 or 2 minutes in a dilute solution of hydrochloric acid, which has the effect of dissolving the hydrated oxides of iron without appreciably attacking the metal. After careful washing and drying, the rods are reweighed and the loss may be taken to represent approximately the loss of metal due to corrosive action under the conditions stated. Although it is realised that the results are not quantitatively accurate, they are considered to be sufficiently so for a comparison to be made and for the effect of such waterproofing compounds in preventing corrosion to be ascertained.

(*g*) *Adhesion of reinforcement.*—The object of this test is to determine whether the adhesion of cement mortar to embedded steel is affected by the use of integral waterproofing compounds.

For this purpose a series of 6 in. cubes of 3 : 1 sand and cement should be made, each cube having a ⅜ in. round steel rod embedded the full depth of 6 in. along the axis of the cube. The rods should be of mild steel previously pickled to remove mill scale and a thin film of rust allowed to form before embedding. After maturing in water for a period of, say, 28 days, the cubes may be tested by being fixed and by suspending a tank from the projecting end of the rod and allowing the tank to gradually fill with water until the load overcomes the adhesion of the mortar to the rod. The weight of the tank plus water will represent the shearing stress between the mortar and steel, the average of the results of 3 cubes being taken in each case.

Providing that such waterproofing compounds have been found to have no deleterious action on the physical and chemical properties of Portland cement and reinforcement, the data obtained from the porosity test should enable an accurate estimation of the value of such compounds to be made. From these results it will be possible to ascertain the minimum quantity of cement required to produce an impervious mortar or concrete when treated with each of the respective compounds, and comparison can be made of the cost of such mixtures with an impervious mortar containing perhaps a greater percentage of cement but without the addition of a concrete waterproofing compound.

OIL AND GAS FIRES.

A monograph on "Extinguishing and Controlling Oil and Gas Fires," by C. P. Bowie, has recently been issued by the U.S. Bureau of Mines (Bulletin 170, Petroleum Technology 48, 20 cents). In the introduction it is stated that during the ten years 1908—18, approximately 12,850,000 barrels of oil and 5,024,506,000 cub. ft. of gas were destroyed by fire in the United States, involving an estimated property loss of $25,252,200. During this period 503 oil and gas fires were reported, of which 310 were caused by lightning and 193 by other causes, chief amongst which was frictional electricity.

Water being immiscible with oil, is rather unsatisfactory for extinguishing most oil fires, particularly if the volume of oil be large. In the case of an outbreak of fire in an oil tank, a common practice is to feed steam into the top of the tank and so exclude air from the space above the burning oil. This method is not entirely satisfactory, and the frothy-mixture system of fire fighting has been recently devised as a more satisfactory procedure. Essentially this system provides for bringing together two suitable chemical solutions and for spreading over the surface of the burning oil the thick tenacious foam resulting from their admixture. The solutions should be such that on mixture, an abundance of relatively tough bubbles inflated with a non-inflammable gas is produced. The mixture of 50 c.c. of each solution should produce from 600 to 800 c.c. of foam. The following pair of solutions has been employed for this purpose :—Solution A, water 100, aluminium sulphate 10, sulphuric acid 66° B. ½; solution B, water 100, ground glue 1¼, sodium bicarbonate 7½, arsenious oxide $\frac{1}{32}$. The relative proportions of the constituents as stated are by weight. The compositions of two other pairs of solutions frequently employed are also given. The solutions are stored in separate tanks and are delivered therefrom to foam-mixing boxes. The foam resulting on mixture is poured from the mixing box on to a number of baffle-plates arranged above the surface of the oil, so that the constituent bubbles of the foam are not destroyed by impact with the oil surface. In the more recent installations, foam slides are omitted, and the bubbles remain intact after a sheer drop of 20 feet or more. The system requires thorough inspection, and the complete cost including turbine, pumps, piping, tanks, labour, etc., is about 3 cents per barrel capacity of all the tanks protected.

Frothy mixture systems may be operated either manually or automatically, the action of the latter type depending upon the fusion of a plug of fusible material. The flow, having commenced, is maintained either by gravity or gas pressure.

Gas well fires can usually be readily extinguished by means of steam. The usual practice for purposes of safeguard is to set up portable field boilers in the vicinity of the wells and to surround the burning well with steam pipes. A portable extinguisher operating on the snuffer principle has been successfully used on small gas fires.

To prevent the starting of fires by frictional electricity in filtering gasoline, fine wire gauze should be used for straining purposes, the use of chamois skin for this purpose being entirely prohibited. Wooden buckets should not be used for drawing gasoline from pumps. Moreover, the metal of the funnel employed during the delivery should invariably be in contact with the metal of the tank. The tank trucks of the Shell Co., California, are grounded when in the garage for filling purposes. Copper chains are soldered to the spouts wherefrom the oil is delivered, the chain making

contact with the bottom of the tank into which the oil is being supplied.

Small gasoline fires are readily extinguished by means of sawdust, the efficacy of the method being improved by mixing sodium bicarbonate with the sawdust in the proportion of about 8 lb. of bicarbonate to 1 cub. ft. of sawdust. Frothy mixtures made up as already described and put up in portable containers are also useful for the same purpose. In order to obtain the best result with carbon tetrachloride as a fire extinguisher, it should be sprayed on the edges of the fire and not into the body of it.

Gasoline storage tanks should be placed underground, preferably outside. The gasoline should be drawn therefrom by pumps and in no case should a gravity flow be arranged. Grease, oil and suchlike inflammable liquids should be removed from waste water before the water enters the sewers.

The paper, which is well illustrated with 19 plates and 4 figures, also contains particulars of risks and precautions associated with tank farms, refineries and wells, and concludes with a bibliography of oil fire hazards and prevention from 1893 to 1917.

CORRESPONDENCE.

CHEMICAL COMPENDIA AND ABSTRACTS.

Sir,—With regard to the much discussed subject of chemical compendia and abstracts, I think everyone is agreed that the present wasteful duplication of abstracting ought to cease and that some Central Bureau should undertake all abstracting work, but until the authorities controlling the present journals responsible for abstract work make a move towards co-operation I expect little or nothing will be done. Such a Central Bureau would also be a suitable authority for issuing English chemical compendia of the Beilstein and Richter type. This is a sphere in which the Department for Scientific and Industrial Research might take a primary interest and form, preferably in collaboration with governments of other countries, the nucleus of a national index of scientific information which is another crying necessity.

The suggestion that contributors to all journals be obliged to supply abstracts of their own papers is a good one. I would go further. All published papers should contain, preferably at the end, a concise summary of work carried out and results obtained followed by the conclusions to be drawn from such results. These portions, "Summary" and "Conclusions," should form an integral part of the paper as published, and the work of the abstractor would in the great majority of instances simply consist in the excision of these portions for the Journal of Abstracts.

The most suitable form for chemical compendia could only be arrived at after discussion by a body of experts appointed for the purpose and, possibly, by concrete trials of various suggestions.

I am, Sir, etc.,

J. Weir.

Ardeer: Sept. 2, 1919.

James Watt Centenary.—A very large number of engineers from all parts of the world is expected to attend this centenary to be held at Birmingham on September 16, 17 and 18. Proposals have been put forward to endow a James Watt chair of engineering at the University of Birmingham for the investigation of the fundamental principles of power production, and for the erection of a James Watt memorial building to serve as an engineering museum and also as a meeting place and library for scientific and friendly societies.

PERSONALIA.

Sir George Beilby has been appointed president of the newly formed British Empire Sugar Research Association.

Following the resignation of Prof. J. J. Henderson from the chair of chemistry at the Royal Technical College, Glasgow, the following appointments have been made in the department of chemistry at the College: Dr. Thomas Gray, professor of technical chemistry, to be director of the school of chemistry; Dr. F. J. Wilson and Dr. J. M. Heilbron to be professors of inorganic and analytical chemistry and of organic chemistry, respectively.

The Lord President of the Council has appointed Prof. J. E. Petavel, F.R.S., to be director of the National Physical Laboratory in succession to Sir Richard Glazebrook who retires on reaching the age limit on September 18 next. Prof. Petavel is professor of engineering and director of the Whitworth Laboratory in the University of Manchester, and a member of the Advisory Committee for Aeronautics of the Air Ministry.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

In his presidential address to the Chemical Section of the British Association at Bournemouth on September 9, Prof. P. Phillips Bedson, in his introductory remarks, paid tribute to the memory and life-work of Sir William Crookes and Professors Baeyer and Fischer. He then dealt with the history and development of the Periodic Law. The pioneering work of Newlands, Mendeléeff and Lothar Meyer was briefly reviewed, and attention directed to the work of Carnelley whose experimental investigations added materially to our knowledge of the physical properties of elements and compounds. Referring to anomalies of position in the Periodic Table, it was remarked that tellurium has resisted all attempts to bring it into order. The discovery of the rare gases necessitated the creation of a zero group as a constituent of the Table. Mendeléeff suggested that this zero group should contain a member lighter than hydrogen in Series I, and in a zero series a still lighter representative, which he has postulated as the "ether" of the physicist. Provision is still to be made in the Table for the accommodation of the rare earths. The contributions of Carnelley, Crookes and J. J. Thomson were briefly alluded to and reference was made to the phenomena of radioactivity as affording a method for the detection of new classes of elements. The phenomena in question indicate that the elements are to be regarded as divisible into three classes termed isotopic, isobaric, and normal, respectively, according as they differ in atomic weight, chemical properties or in both. The work of Moseley directed attention to the importance of the atomic numbers of the respective elements as affording evidence of the position of the elements in the periodic sequence. The evidence derived from this source supports the positions attributed to tellurium and iodine, potassium and argon in the Table. The concluding section of the address was devoted to remarks concerning the pre-war apathy of the public and of the Government concerning the national value of the chemical industries. The well known cases of the manufacture of dyes and of explosives were instanced and the lecturer regretted that even now there exists, and not only in the minds of the ignorant, a lack of information as to how chemical research has ministered to the amenities of everyday life.

NEWS AND NOTES.

CANADA.

A New Goldfield in Quebec.—According to a *Reuter* message, a new goldfield has been discovered on the shores of Lake Kienawicch, Quebec, where a Polish settler has sold his rights for £170,000.—(*Official.*)

UNITED STATES.

Bibliography on Helium.—Mr. E. R. Weaver, of the Bureau of Standards, has compiled a valuable classified bibliography of the literature on helium.

Thermit Welding.—Fourteen hundred pounds of thermit was used to weld a casting on the s.s. *Northern Pacific*, thus constituting the largest marine weld on record. The weld was entirely successful and was accomplished without removing the casting from the ship.

"Chemical Age."—A new magazine, *Chemical Age*, has been established for the benefit of the business man in chemical industry. This publication, which has no connexion with *The Chemical Age* published in London, places special stress upon the economic side of the problems which confront chemists and engineers. *Chemical Age*, of which two numbers have appeared, is published monthly in New York City.

The Chemical Foundation, Inc.—This corporation (see this Journal, 1919, 197 R) has opened offices in New York and is now ready to take up the licensing of various chemical and metallurgical patents. Those applying for licences must be entirely American and have both the skill and facilities to manufacture under the licences sought.

High-grade Filter Paper.—Extensive experiments are being undertaken with the object of initiating the manufacture of the highest grades of analytical filter paper in the United States. Exhaustive work has been done in critically examining the leading papers now on the market with a view to determining the cause of any defect. The information thus gained has been very valuable in devising novel methods in regard to water supply, choice of raw materials and processes.

A New Source of Tannin.—The easily accessible supply of tanbark oak is rapidly becoming depleted on the Western Coast and experiments with other native barks for tanning are already under way. The sequoia, or Californian redwood, is being investigated as a source of tannin, as is also a variety of shrub available in large quantities. The heartwood of the sequoia contains about 12 per cent. tannin and would be available principally as sawdust. Laboratory experiments indicate good results with this tannin, but owing to the development of a colour its use might have to be restricted to the manufacture of sole leather.

Chlorinated Hydrocarbons from Natural Gas.—The existence of large quantities of natural gas, composed almost entirely of methane and free from the higher saturated hydrocarbons, ethane, propane, etc., far removed from industrial centres, and of chlorine in excess of peace requirements at once suggests experiments in chlorination. A preliminary report on the work of the Bureau of Mines indicates that the commercial production of carbon tetrachloride, chloroform and carbon hexachloride (from which ethane tetrachloride may be made) are possibilities. In the laboratory the gas has been completely chlorinated in one operation, the rate of flow largely determining the nature of the products. A catalyst having a high absorption value for chlorine is essential. Besides carefully controlled conditions for the reaction, efficient means for removing the products must be employed. Experiments on a semi-commercial scale are now to be undertaken.

JAPAN.

Researches on the Mucilage contained in certain Florideæ.—In an investigation on the mucilages of several varieties of marine algæ belonging to the natural order *florideæ* found in the Sea of Japan, which are widely used for cloth finishing as well as for wall stiffening material, Mr. E. Takahashi has found that one variety, *Tsunomata*, yields galactose, arabinose, mannose, dextrose, laevulose, and another sugar resembling galactose which crystallises in rectangular plates, has a specific rotatory power $[\alpha]_{D_{20^\circ}} = 80{\cdot}75^\circ$, and a melting point of 152°—153° C.; it does not yield an acid on oxidation with nitric acid. This hitherto unknown sugar, named by the author "floridose," has been found to be a hexaldose which on reduction yields a hexahydric alcohol—floriditol. The mucilage of *Funori* has been shown by the same author to yield galactose, arabinose, fucose, dextrose, and laevulose, but not "floridose." Mr. Takahashi draws the conclusion that the chief constituents of these mucilages are galactan, araban, and a new compound "floridosan" which on hydrolysis yield the sugars galactose, arabinose, and floridose, respectively.

Sulphur Production.—The chief deposits of sulphur in Japan occur on the island of Hokkaido, those on the islands of Hondo and Kyushyu being less extensive. The output of sulphur diminished considerably in 1918 owing to the sudden cessation of demand subsequent on the conclusion of the armistice; the total production for that year was 64.711 tons, valued at 2,532,425 yen, representing a decrease of 45·2 per cent. in weight and 46·9 per cent. in value compared with 1917.

The geological formation of the sulphur districts is not uniform. In some localities large masses of sulphur are found covered with volcanic lava, in others the mineral occurs mixed with clay. At Iwaoto there is a deposit of precipitated sulphur, and another consisting of intrusions of fused sulphur in a sandy bed. The deposit at Horobetsu shows a continuous vein of pure sulphur in the form of irregular granules. Speaking generally, the crude material contains 30—60 per cent. of sulphur, and this is refined up to 99—100 per cent. quality by the operations of sorting, crushing, drying, distilling and moulding. The distillation is carried out in cast-iron stills of 3 ft. diameter connected with a condensing chamber measuring 20 ft. long and 2 ft. 5 in. diameter. In the past the stills have been heated by direct firing, but recently steam heating has been introduced with successful results. The following table gives the chief deposits of sulphur together with the monthly outputs in March 1918 and 1919:—

Locality.	Monthly Output. Metric Tons. March 1919	March 1918
Hokkaido.		
Shikabe (Oshima) ...	... 108	235·8
Kumadomari (Oshima)	... 153	436
Iwaoto (Shiribeshi) ...	... 242·8	483·5
Okujiri (Shiribeshi) ...	... 1207	1145·8
Tsurikake (Shiribeshi)	... 307	—
Horobetsu (Iburi) ...	... 279	859·6
Hondo and Kyushyu.		
Zo-o-zan (Yamagata)	... 119·8	124·5
Numajiri (Fukushima)	... 148·6	798·6
Matsuo (Iwate) ...	... 611	584·5
Akakura (Akita) ...	... 128·8	77
Nasu (Tochigi) ...	... 30	629
Hirayama (Tochigi) ...	... 94	145·6
Yonogo (Nagano) ...	... 90	106·8
Konoyeyama (Oita) ...	... 80	135
Iwojima (Kagoshima)	... 35·4	40

Work has recently been stopped at the Katsutani and Araodake deposits; each of these produced over 100 tons monthly until last year.

BRITISH INDIA.

Experiments in Wood Distillation.—As a result of exhaustive experiments carried out by the United Provinces Forest Department, the distillation of "Chilka" wood from *Pinus longifolia* for the production of "Stockholm" tar has now been commenced on a commercial scale in the West Almora Division, and shows promise of becoming a profitable industry. Attempts to find a market for the by-products of distillation, a tarry oil and pyroligneous acid, have been successful, and it is stated that the total output of these products will be taken by the Army Department. At the suggestion of the Divisional Forest Officer, a series of experiments has been carried out with the object of determining the possibility of utilising inferior broad-leaved soft woods for the production of charcoal and tar. The series experimented upon were *Mallotus philippinensis*, *Kydia calycina*, and *Odiner Wodier*, and also Ban oak and sal for purposes of comparison. A number of charges was distilled, and although an excellent grade of charcoal was obtained, the yield of tar, 1·5 per cent., is too low to make it commercially profitable to utilise such species as a source of wood tar.—(*Report of Board of Scientific Advice*, 1917—18.)

GENERAL.

Report Writing in Chemical Works.—A correspondent who occupied a responsible position in one of H.M. Factories during the war communicates the following form of report adopted by the Department of Explosives Supplies, Ministry of Munitions, and which experience proved to be particularly serviceable for the purposes required. The form of the report, changed in detail to suit circumstances, consists of:—

(*a*) The mere formalities of submission.

(*b*) A brief title covering the work.

(*c*) A short paragraph headed "Object," briefly explaining the purpose of the investigation.

(*d*) A very brief summary of "Results" where necessary to lead up to (*c*) and (*f*).

(*e*) A brief statement of the "Conclusions" arrived at.

(*f*) A short paragraph headed "Recommendations." Under this heading suggestions arising out of the work are recorded, particular attention being paid to the effect on existing works practice, and to their financial bearing. On the latter point due attention must be paid to the capital expenditure involved as well as to expected economies in operating costs.

(*g*) A concise summary, headed "Experimental," of the methods adopted for the purpose of the research together with a sketch of the apparatus used, statements of experimental results and, where possible, a graphical representation of the numerical results. Tables should be clearly headed, and incorporated with the section to which they refer. Curves and diagrams, bearing appropriate titles and reference numbers, should be collected at the end of the report.

The object of this form of report is to present the work done in the most useful and most easily assimilated form.

Position of Chemists in the Special Brigade, R.E.—The note on this subject in our last issue (310 R) has elicited a reply from one of the Brigade who served in it as a sergeant and later as an officer. In his opinion those who, like himself, were transferred from the line as privates to the Brigade were extremely lucky in being able to quit the "mud and agony" of trench warfare for a "haven of refuge." It is better to be a "plumber" or a "navvy" than cannon-fodder.

Oil and Cattle Food from Rubber Seeds.—It is stated that exhaustive experiments have been made on the utilisation of Para rubber seeds for oil suitable for paints, varnishes, soaps, etc., and that the cake produced from the residue after the oil is extracted compares favourably with linseed and other oilcake as a food for stock. Rubber-seed oil has been sold at 250 dollars a ton at a time when linseed oil cost 300 dollars. In British Malaya alone no fewer than 633,000 acres was actually producing rubber last year and the seeds, estimated at 300 pounds to the acre, are at present allowed to fall to the ground and rot.—(*U.S. Com. Rep.*, *July* 25, 1919.)

Position of German Sugar Industry.—Never during the war was the future of the sugar industry so uncertain as it is at present. On the whole the war period was one of good profits, but it cannot reasonably be expected that these will be maintained for wages and prices of materials have risen by 300—400 per cent. in Germany as against 100 per cent. in the Entente countries. The raising of the price of beet by the Government from 3 to 4 marks per cwt., although intended to stimulate production, will also affect the industry adversely. Measures to regulate the distribution of preserving sugar (which apparently will not be available this summer) have been wholly neglected; and illicit trading in sugar has gradually become a plague as it withdraws large quantities of the diminished production from its rightful channels. Although the Government decreed that at least as much beet was to be grown this year as last, the area under cultivation is less by 10—15 per cent.; and this year's crop is very backward owing to the low rainfall. Up to now the refineries have had sufficient reserves to be able to supply sugar to the dependent industries, and the distribution to the public by the local authorities has not been seriously disturbed.—(*Z. angew. Chem.*, *June* 24, 1919.)

Lupine Bread.—Lupine seeds cannot be used directly for breadmaking owing to their content of bitter substances. Prof. Pohl, of Breslau, has, however, shown how the latter can be completely removed by thorough washing. The purified flour contains:—Cellulose 5—10%, hemicellulose 4·6—7%, fat 8·7—10%, nitrogen = 56—63% albumin, and soluble carbohydrates about 20%. As the flour contains no starch it is admixed with 4 parts of rye flour. Apart from a slight specific odour, the resulting bread is indistinguishable from pure rye or wheaten bread, although of higher nutritive value as it contains nearly twice as much albumin and more fat. According to Pohl, the bread is faultless notwithstanding a negligible poison-content of the order of one-thousandth per cent. The Berlin authorities are interesting themselves in the new foodstuff, which may serve to meet the German want of albuminoid substances.—(*Z. angew. Chem.*, *June* 20, 1919.)

German Potash Undertakings in Alsace.—At an extraordinary meeting of the Kaliwerke St. Therese, A.-G., held at Mülhausen, it was resolved to increase the capital of the company from 8 million to 10 million marks. The sinking of two new shafts is contemplated, and a loan amounting to 20 million francs has been authorised for this purpose. Subscriptions to this loan will be accepted by a group of French banks. The order issued in 1915 for the compulsory liquidation of French capital invested in the company has been annulled by order of the French Government. The future of other German potash ventures in Alsace is as yet undecided. The establishment of a large potash group or syndicate to embrace most of the works is contemplated by France, the necessary capital of which is estimated at 50 million francs.—(*Z. angew. Chem.*, *July* 4, 1919.)

The German Iron Industry.—The dearth of raw materials is still affecting production, which is now only about 30 per cent. of the peace time output, but the most serious factor is the refusal of the men to work. There is little hope of improvement for some time to come. Export trade is suffering and a great deal of business has been lost through the impossibility of prompt delivery. In prices American products hold the field, for instance American bar iron is being offered at Rotterdam at 180 florins per ton while the German price is 500 florins. The prospects of the Germans being able to recover their export markets in the future are somewhat doubtful. The importation of foreign ores, with the unfavourable state of exchange, will be a heavy burden on production costs. French competition will be keen, and will be backed by the ore productions of the conquered territory, and the German manufacturers are afraid of a strong invasion of the united Franco-Luxemburg-Belgian iron and steel mills.—(*U.S. Com. Rep., July* 26, 1919.)

"Tar Oils" in Germany.—Prof. H. Grossmann of Berlin states that successful attempts have been made during the war to render Germany independent of foreign sources of substances hitherto derived from imported petroleum oil. Large quantities of "tar oils" have been obtained from coal. This oil is a portion of the anthracene oil which distils over between 300° and 360° C. Crude anthracene and phenanthrene are removed therefrom by cooling, crystallisation and filtration. The more easily vaporised constituents are removed from the filtered anthracene oil which is once more cooled, and the last solid constituents precipitated. The oil so obtained serves for the preparation of various lubricating oils. By long continued heating at a high temperature a very viscous oil is obtained which was much used during the war. The tar oils can be mixed with mineral oils, and can be used for the manufacture of lubricating greases. It is computed that from the annual production of 1,500,000 tons of gas and coke-oven tars some 150,000 tons of such tar oils could be obtained.

The production of tar by the low temperature distillation of coal and lignites was also undertaken during the war, but no accurate returns as to the quantity produced are yet available. The tar oils resemble petroleum very closely in chemical character, and can be utilised for the production of benzene, illuminating oil, lubricating oil and paraffin. The yield of low temperature tar from brown coal averages from 10 to 20 per cent. of the dry substance, the yield from types of gas coal being about 8 to 12 per cent. Two principal methods of procedure are employed for obtaining the low temperature tars. In the one, the distillation of the coal is effected at a temperature not exceeding 500° C., much tar, little gas and ammonia being obtained. In the other method, which has hitherto been most generally employed, the coal is distilled in generators of various forms, the low temperature distillates being removed without further subjection to a higher temperature than that of their production. In working up these tars large quantities of phenolic substances are obtained, and the utilisation in peace time of these products and of the coke produced is a pressing problem. Possibly Germany may be made entirely independent of imported tar oils by the use of the Bergin process which renders possible the working up of tar and tar products, including pitch, into very valuable materials, by subjecting them to the action of hydrogen. It may also be found possible to submit the raw coal or lignite to the action of hydrogen in such manner that oil and benzene are obtained directly. The solution of this problem will put Germany on an entirely new footing as regards its supplies of combustible material and of power.—(*Schweiz-Chem. Z.*, 24—26, 1919.)

Increasing the Yield of Ammonia from Coal.—The yield of ammonium sulphate by the carbonisation of bituminous coal containing about 1·5 per cent. of nitrogen, amounts, in the case of even the largest gas undertakings, to only about 26 lb. of sulphate per ton of coal, compared with a possible yield of 160 lb., on the assumption that the whole of the nitrogen content of the coal is recoverable in the form of ammonia. The recovery in the Mond system is approximately 96 lb. of ammonium sulphate per ton of coal. By the steaming of continuously operated vertical retorts the normal yield, without steaming, of 35 galls. of 8 oz. ammoniacal liquor per ton of coal is increased to from 50 to 60 galls. These results are at least partly explained by the work of Tervet and that of Beilby, who obtained increased ammonia yields by passing respectively hydrogen and a mixture of air and steam over the incandescent coke. The recent process of Perkin and West (this J., 1918, 295 A. Eng. Pat. 114,937) employs a stream of low quality gas introduced at the base of a vertical retort for the same purpose. Salmang (this J., 1919, 452 A), by passing a mixture of steam and air through the fuel bed to which chalk or oxide of iron was added, obtained, under the most favourable conditions, a recovery of 96·3 per cent. of the nitrogen as ammonia, a recovery of 59 per cent. being obtained without the addition of chalk or oxide of iron. With the exclusion of air, the maximum recovery obtained by Salmang was 20 per cent. less than with a steam-air mixture. Sommer has shown that the maximum yield of ammonia with typical German coals occurs when distillation temperatures between 800° C. and 900° C. are employed. He maintains that 79 per cent. of the total nitrogen of the coal is retained in the coke, contrary to the results of other workers who have shown that with high temperature carbonisation, 50 per cent. of the total nitrogen remains in the coke. Sommer finds that the presence of steam tends to conserve ammonia. He expresses the opinion that the inclined chamber oven is productive of better results than can be obtained with the vertical retort. A similar advantage is obtained by increasing the size of coke ovens and by lowering the level of the upper collecting flue, benzol being likewise thereby conserved. The moisture content of coal certainly augments the amount of ammonia derived therefrom. Oxygen evolved during the process of carbonisation tends to lower the yields of ammonia and benzol. Hydrogen sulphide is oxidised very much more readily than ammonia, and its oxidation is considerably accentuated in the presence of water vapour. The presence of sulphuretted hydrogen in the gas evolved, therefore, serves to conserve ammonia. In high temperature carbonisation, hydrogen is freely evolved during the later stages, and ammonia is produced therefrom in accordance with the Tervet reaction, while some of the ammonia so produced is doubtless subsequently decomposed. Further research in the direction of admitting "stripped" coal-gas or blue water gas to the charge is desirable, with a view to obtaining an increased yield of ammonia.—(*Times Engineering Supplement, Aug.* 1919.)

Zinc Industry in Belgium.—A short report bearing this title has been written by M. F. Chase and issued by the United States Bureau of Mines in the "Minerals Investigations Series." In 1913 there were 14 plants in operation with 43,253 retorts; the number of workers was 8444 and 998,655 tons of coal were consumed; 488,730 tons of ore were treated and 204,220 tons of spelter were produced, or approximately 20 per cent. of the world's production. There were 10 rolling mills, with 34 rolls

and 742 workers, producing 49,120 tons. The actual value of all the products from treating zinc ore was 225 million francs. Of the ore, 840 tons came from Belgium, 175,000 tons from Australia and the remainder chiefly from Sweden and Sardinia.

The general custom in Belgium has been to roast zinc ores at chemical works and then transport the roasted ore to the smelting plants. Only 4 out of the 14 smelting plants have roasting plants attached. The total capacity of these 4 smelter roasting plants was 100,000 tons of ore per year. There were 10 chemical works having a zinc ore roasting capacity capable of treating somewhat over 300,000 tons a year. Owing to the large amount of Australian ore, smelting practice has developed the recovery of lead and silver values from the furnace residues.

The location and capacity of the 14 smelting plants are:—

Name of Company	Location	Retorts
Austro-Belge ...	Corphalie	2200
Biache-St. Vaast...	Ougrée	1000
Boom	Boom	1600
Dumont Frères ...	Sclaigneaux ...	6000
de Lamine ...	Antheit	2304
Nouvelle Montagne	Engis	3200
Overpelt-Lommel	Overpelt	2684
,, ,,	Lommel	2568
Pennarroya ...	Bleyberg	1700
Prayon	Foret	3840
Rothem	Rothem	3360
Vieille Montagne	Angleur	5440
,, ,, ...	Flone	4000
,, ,, ...	Valentin-Cocq ...	10,800
		50,696

Two plants were equipped to treat the residues producing lead, and also refined silver. About 60 per cent. of the smelting capacity can be said to be of modern construction, and in the newer works the tendency has been to increase the mechanical handling and also the mechanical charging and discharging of the furnaces. In roasting practice, hand-raked furnaces are general, and, although the mechanical or semi-mechanical roasters are not entirely successful, they require less labour per ton of roasted ore, and the Belgian plants will be thus at a serious disadvantage.

The general conclusion arrived at is that the future of Belgium as a zinc-producing country is not particularly bright, but that the relative position it will occupy from now on is not easily predicted. The opinion is expressed that for some years to come production will be far below the pre-war figures, and may never reach the 1913 level. During the last two years the idle plants suffered largely from lack of maintenance and from equipment being removed. To obtain lead, the towers and chambers of the sulphuric acid plant were dismantled. The smelting plants that were German-owned operated to a limited extent during the entire period of the occupation, and are in a fair way to resume work on an extensive scale. In others, much property was destroyed to get cast iron, copper and steel scrap. Rolling stock, machinery, belting, and practically all of the copper transmission lines were removed. The rehabilitation of the industry, even to a limited extent, will depend upon obtaining prompt and reasonable supplies of ore. If these are not provided promptly, the greatest asset that Belgium had, that is the skilled workman, will be lost, as these men undoubtedly will seek employment either in other countries or in other industries. The smelting capacity outside of Belgium has been so vastly increased that only the plants operating on low cost and high recovery can hope to compete successfully. Even before the war it was becoming evident that further reductions in smelting cost must be made. The Belgian engineers have contributed largely to the metallurgy of zinc, and, while they are now handicapped in so many ways, it is entirely within the realm of possibility that they can meet the situation and restore the industry to a fair percentage of what it was before the war. The longer this restoration is delayed the more difficult the problem becomes.

We understand that recent negotiations respecting contracts for the supply of Australian concentrates to Belgium have received a check owing to difficulties arising particularly in regard to freight. It is hoped that the difficulties will be overcome and that the contract for the supply of 100,000 tons yearly with buyer's option to increase to 150,000 tons, will be arranged. Meanwhile, it is stated that several works, including the Vieille Montagne and Nouvelle Montagne, have already secured a certain supply of ore and have relighted some of their furnaces.

Fuel from Sulphite Waste Lyes.—The Commercial Agent of the Canadian Government in Norway reports the discovery of a new method of producing fuel from sulphite cellulose waste, which has recently been tested with very satisfactory results at the Graeker factory near Fredrikstad. It is estimated that 22,000 tons of fuel could be produced yearly from 25,000 tons of cellulose waste. The fuel is obtained as a brownish coloured powder and is burnt in a special kind of grate.—(*Canad. Dept. Trade and Commerce, June* 30, 1919.)

Gold and Silver in 1917.—The United States produced, in 1917, 4,051,440 oz. of gold valued at $83,750,700 and 71,740,362 oz. of silver worth $59,078,100. The supply of new gold in that country is chiefly derived from dry or siliceous gold ores, treated in gold mills by amalgamation or cyanidation, or both, and from placer gravels, largely by dredging. A considerable output of gold is also now recovered from the refining of copper bullion from copper ores. The supply of new silver is derived from dry or siliceous silver and silver-gold ores, and from copper, lead and lead-zinc ores. The bulk of the ores of the former class are milled and cyanided at or near the mines, and that from the latter by the refining of copper and lead bullion produced in smelting.

The present tendency, in the absence of discovery and development of new gold fields on a large scale, is towards a declining world's output of new gold, and this tendency is accentuated by the high cost of labour and supplies, which makes the operations of many gold mines unprofitable.

In 1917, North and South America produced no less than 87 per cent. of the world's total production of silver.

The average value of precious metal extracted from U.S. minerals was, in dollars per ton of ore:—Siliceous ores 5·56, copper ores 0·49, lead ores, 6·88, zinc ores 0·90, copper-lead and copper-zinc ores 14·58, and from lead-zinc ores 2·82.—(*U.S. Geol. Survey, May* 1919.)

The Newcastle Chemical Industry Club.—This club, which at the date of opening in May last had 84 members on its roll, has now a membership of 109. In response to an appeal for funds to establish a library, over £300 has already been received. The first item in the list of fixtures for the coming months is a "field day" to be held at Durham City on September 27.

REPORTS.

REPORT OF THE COMMITTEE OF THE PRIVY COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH. 1918-19. Pp. 94. [Cmd. 320, 6*d*.] (London: H.M. Stationery Office.)*

The fourth annual report covers the period from August 1, 1918, to July 31, 1919, and like its predecessors contains a short report by the Privy Council Committee and a long report by the Advisory Council. The former refers to successful researches undertaken in connexion with enemy mines and submarines, condensers in fast ships of war, flying at high altitudes and mining operations in the field, and to the pre-eminent services rendered by the National Physical Laboratory to all the military Departments of State. Other Government Departments have made increasing use of the organisation, and experience has shown the advantage of entrusting long, complicated and fundamental researches to a central department which is free from the daily embarrassments of administration. Stress is laid once again upon the urgent need of increasing the number of trained research workers; all plans for research must make the best use of existing institutions and personnel, and ambitious schemes for self-contained and independent organisations can have no ultimate success.

The administration of the Geological Survey and Museum is to be transferred to the Department for Scientific and Industrial Research on November 1 next, and the custody of the primary electrical standards and the testing of electrical instruments for use as secondary standards have already been moved from the Board of Trade to the National Physical Laboratory. The expenditure on the Laboratory was £116,038, and the estimated expenditure for the current year is £154,650. A grant of £10,000 has been approved, subject to Treasury sanction, to the Medical Research Committee for the work of the Industrial Fatigue Research Board. The sum standing to the credit of the Imperial Trust for the Encouragement of Scientific and Industrial Research at June 30 was £1,061,183, and the expenditure to that date had been £17,506. The trustees of this fund are committed to a further expenditure of £198,000 on eight Research Associations, and it is estimated that at least £175,000 more will be required for Associations now being formed. The number of Associations will probably eventually be between 40 and 50. Allowances or grants to 35 students under training in research and to 68 workers either working independently or as assistants amounted to £14,170, compared with £7,500 for 1917-18. Aid will now be given for 28 scientific investigations conducted by other bodies. The total expenditure of the Department for 1918-19 was £177,201, of which £8,722 was provided by the million fund.

The report of the Advisory Committee lays down, in the introduction, a number of postulates concerning the functions of the State in regard to research. (*a*) The State should encourage research in pure science but not attempt to organise it; it should, however, organise research into problems directly affecting the welfare of large sections of the community. (*b*) The State research department should act as a central clearing house. (*c*) No investigations for the immediate benefit of industries not under State management should be conducted by the State department. (*d*) The exploitation or commercial development or administrative application of the results of research does not come within the sphere of action of a State research department.

Industrial Research Associations.—Up to July 31 last licences had been issued to research associations for:—Photography, scientific instruments, woollen and worsted industries, Portland cement, boot, shoe and allied trades, motor and allied manufactures, Empire sugar, cotton industry, and iron manufacture; and the list of associations "approved" at the same date included:—Rubber and tyre manufacture, music industries, linen industry, glass, chocolate, cocoa, sugar confectionery and jam manufacture, Scottish shale oil trade, non-ferrous metals, and refractories.

The original guarantee for a total expenditure of £40,000 during 5 years by the British Scientific Instrument Research Association, subject to the members contributing £4,000 out of revenue, has been increased by an additional sum of £24,000—£30,000. This very exceptional treatment has been accorded owing to the "key" nature of this industry, and a similar concession has been granted to the Glass Research Association for a similar reason. Claims for exceptional treatment can only be considered when the cost of the necessary research is great in relation to the means of the association, and payment on a higher scale than the normal can only be given if the industry concerned is essential to the existence of larger industries and to the defence of the realm, and if proof is forthcoming that any special advantages accruing from Government policy are in themselves insufficient.

The British Research Association for the Woollen and Worsted Industries has already achieved results in investigating the action of acids, alkalis and soaps on wool, the effect of manufacturing processes on textile fibres, the milling of wool, and the electrification of fibres. The establishment of the Scottish Oil Trade Research Association has been suspended owing to the serious outlook caused by the increased cost of labour, and the projected association for engineers and shipbuilders of Scotland and of the North-east Coast of England has not yet been realised. There is only one association connected with the engineering group of industries.

Ownership of Results.—In January last a very important modification was made in the conditions of grant, whereby all results of investigation are to belong to the associations, which are to hold them in trust for the benefit of their members. This ownership is subject to two conditions:—The Department may (*a*) effect the communication of results to other industries, co-operating bodies and persons, on certain terms and conditions, (*b*) veto the communication of results to foreign interests.

Limits of Co-operation.—Difficulty has been experienced in combining within the same association the makers and users of goods, and both the Cotton and Wool Associations have refused to take common action with the merchants.

"It is probable that certain industries will never form Research Associations—either because their commercial unit or factory unit is so large that they are able to conduct their own research without joining their competitors in a co-operative scheme, or because the sharing of results obtained by research does not suit the conditions of the industry. The explosives industry and the dye industry, which are now in the hands of practically single combines, are examples of the first, and the heavy chemical industry is a case of the second class."

The Position of Consultants and Analysts.—It is very important that research associations should define clearly their attitude to consultants or

* To be purchased through any bookseller, or directly from H.M. Stationery Office at the following addresses: Imperial House, Kingsway, London, W.C.2, and 28, Abingdon Street, London, S.W.1.; 37, Peter Street, Manchester; 1, St. Andrew's Crescent, Cardiff; 23, Forth Street, Edinburgh; or from E. Ponsonby, Ltd., 116, Grafton Street, Dublin.

analysts, and it is hoped that they will agree not to undertake for their members any routine work of the kind hitherto undertaken by the professional analyst or consulting engineer. One association has agreed to make a panel of consultants and analysts to whom its members can apply for technical assistance, which it is not the proper function of a research association to supply. Although the higher kind of consulting work is not susceptible of this treatment, there is no reason to believe that original workers among consultants will find their services neglected as a consequence of the establishment of these associations; the reverse is the more probable effect.

Part II. of the Report deals with researches which the Department is undertaking for national purposes. Under this heading is included the work of the National Physical Laboratory, of the Fuel Research Board (pulverised fuel, gas standards, and work for the Dominions), the Peat Inquiry Committee, the work of the Power Alcohol Interdepartmental Committee, of the Mine Rescue Apparatus Research Committee, the Food Investigation Board, the Tin and Tungsten Research Board, the Oxygen Uses Co-ordination Committee, the Gas Cylinders Committee, the Committee on Lubricants and Lubrication, the Abrasives and Polishing Powders Research Committee, the Industrial Fatigue Research Board; and investigations on timber, building, metal struts and spars for aircraft, brass and copper castings, copper and zinc, and certain researches on the preservation and restoration of antique objects in the British Museum undertaken by Dr. Alexander Scott.

Then follows an account of the activities of kindred Government organisations in the Overseas Dominions and in the United States, France, and Italy.. The Secretary of State for the Colonies has appointed a Research Committee to administer a fund of £100,000 for the encouragement of research in the non-self-governing Dominions of the Crown during a period of five years.

Part III. describes the more important developments that have taken place in researches initiated by other bodies and aided by grants from the Department, such as investigations on hard porcelain by the Joint Research Committee of the Stoke Central School of Science and Technology and the Staffordshire Potteries Manufacturers' Association, and the Institute of Glass Technology in Sheffield University. A complete list of aided researches undertaken by scientific and technical societies is given in an appendix.

Publication of Results.—Certain modifications have been made in the conditions under which grants for pure science are made to research workers and students in training. After careful consideration of the objects of such grants, *viz.*, to prevent exploitation of results by individual firms and to secure an adequate share of rewards to the discoverer or inventor, the Council has come to the conclusion that these objects can be sufficiently secured without requiring the submission of all results to the Department before they are published. Only in exceptional cases in which results of commercial value are obtained is it desirable to limit the freedom of publication. Hence it has been decided that an aided research worker shall be free to publish his results where and when he thinks best, provided that, in the opinion of the Council, the subject of investigation is one which is unlikely from the outset to lead to results of commercial value; but the research worker may not take out a patent or make other commercial use of any results without previous consultation with the Department.

The total number of grants made to individual workers has increased from 67 to 103; of these, 72 were new grants, and 66 were grants made to workers in pure science as compared with 28 to workers in applied science.

Inventions and Patents.—The Report concludes with a discussion of certain questions connected with the administration of patents. No worker under the Department may take out a patent without the consent of the Committee of Council, and where leave is given it must be taken out in the joint name of the inventor and of the Imperial Trust. The Department reserves to itself complete discretion in the administration of patent rights after consultation with the inventor; and the Trust reserves the right to refuse to be a party to a patent covering a discovery made under a Committee or Board of the Department or by a worker in receipt of a grant. Among the problems awaiting solution is the administration of foreign patents based on State-aided inventions; but on the general question of patentability it has been provisionally decided that patents should not be taken out for (*a*) inventions of value for the preservation of health or of life, or (*b*) inventions the use of which can be enforced by a Government Department. In these cases steps are taken to secure full and complete publication with a view to preventing others from securing a patent for the invention.

In view of the fact that the Department is not concerned with the commercial exploitation of inventions, it cannot undertake to bring inventors into touch with manufacturers.

INTERIM REPORT TO THE BOARD OF TRADE OF THE EMPIRE FLAX GROWING COMMITTEE. [*Cmd.* 281. 2*d.*] (London: H.M. Stationery Office.)

Before the war the world's production of flax was estimated at about 506,000 tons, of which about 400,000 tons was derived from Russia. The United Kingdom produced about 12,000 tons and consumed about 100,000. Of the home-grown crop, Ireland contributed 10,000 tons, and the causes for the almost total extinction of the cultivation of flax in Great Britain were partly the difficulty of procuring rural labour for the special attention which the crop requires at the harvest season, and partly the low price at which the fibre could be imported from Russia. The greatest permanent obstacle to the production of flax in this country is the labour difficulty. Flax should be pulled and not cut, and this entails a large supply of temporary labour. Pulling machines have been invented, but are in an experimental stage. One of the chief essentials for the revival of flax growing is the organisation of centralised retting and scutching factories where these operations could be performed on a large scale and extended over a longer period. As the result of special efforts during the war the production in the north of Ireland was increased from about 8000 tons in 1914 to 15,700 tons in 1918, but it was over 12,000 tons in 1912 and 1913. In the north of Ireland the industry is of the nature of a small home industry, in which all the operations are carried out by the farmer and his staff, whereas if it is to be established in other parts of the country it would be necessary, on account of labour scarcity, to organise it on the large scale, utilising the factory system for preparing the fibre from the crop. This is the policy which is being pushed in Great Britain, where, under the auspices of the Flax Production Branch of the Board of Agriculture, the acreage for 1919 has been increased to 20,000, as against 13,537 for 1918.

The development of the industry in the United Kingdom has been seriously threatened by the scarcity of seed, and the position will not be secure until a certain and satisfactory supply can be drawn from within the British Empire. The Committee regards this as a commercial possibility.

In Canada the variety grown almost exclusively is adapted only for the production of linseed, and the production of flax fibre is relatively small. Efforts have been made to induce the Canadian farmers to grow imported Japanese seed of the fibre variety of flax in order to establish a British source from which fibre seed could be drawn.

British East Africa is probably one of the most promising fields in the Empire for the establishment of a large flax-growing industry, which, however, can only be done by an increase in the transport facilities. In India, Australasia and Africa generally, experimental work has shown that flax can be grown successfully, and it is only a matter of economic and technical development. The Committee concludes that the efforts put forward with considerable success during the war period to encourage and extend the cultivation of flax in the United Kingdom and the Empire should be continued until their full value has been determined. These efforts in Great Britain have been experimental in character with a view to ascertain whether the use of machinery and a central retting system can re-establish the industry on a large scale and on an economic basis. Even if this be found impracticable, the scheme should be continued on a limited scale for purposes of scientific and industrial research. In Ireland the existing schemes should be further developed for the purpose of expanding the present industry, providing instruction in the cultivation and handling of the crop, improving the quality and yield by selection and supply of suitable seed, setting up training centres for instructors and scutchers, and supporting financially the establishment of new scutching mills. The Irish Flax Society should also continue its experimental and research work on the lines suggested for the English and Scotch schemes. In the south of Ireland efforts should be made to establish the industry on factory lines by creating at least two units of 1000 acres each. In Canada the cultivation of suitable fibre seed should be continued in order to establish a permanent source from which seed for the United Kingdom could be drawn. As regards East Africa, the success already achieved supports the hope that this Colony may become in a comparatively short time a main source of flax production within the Empire. The requirements are: (1) Establishment of machinery at central points; (2) development of agricultural research and experiments in flax production; (3) provision of expert assistance in the preparation and grading of flax for the market. The settlement of slightly disabled soldiers in East Africa should be encouraged with a view to the production of flax in those districts proved to be suitable.

Forty-third Annual Report of H.M. Inspectors of Explosives. 1918. [Cmd. 278, 3*d.*] (London: H.M. Stationery Office.)

During the year 1918, 8 new factories were licensed and 8 became extinct, leaving the total number unchanged at 183. The number of magazines inspected was 460, stores 184 and registered premises 158; 155 amending licences were granted for factories and 8 for magazines. Only one case of illegal conveyance was detected. No modification was made in the law.

Messrs. F. H. and P. V. Dupré, chemical advisers, examined 347 samples, of which 62 were rejected. The majority of these were again for excessive moisture, and attention is drawn to the need for careful waterproofing and to the extreme hygroscopic character of explosives containing both ammonium nitrate and chloride of sodium. Only 17 new explosives were examined and the number of testing station samples amounted to 4 only.

The total number of accidents reported during 1918 was 526, as against 701 in 1917, from which 44 deaths and 194 injuries resulted. Of the 44 fatalities, 20 were due to two accidents in which explosive substances were not involved. One, causing 7 deaths and 2 injuries, occurred during the mixing of "deck flare" composition, and the other during the manufacture of incendiary bombs containing a mixture of aluminium, oxide of iron and sulphur known as "thermalloy." In both accidents the material which ignited contained aluminium, and although under test these compositions are by no means hyper-sensitive, accidents with them have been somewhat frequent, the causes of ignition being very obscure.

In addition to accidents investigated under Section 66 of the Act a considerable number of others were investigated (of these a number are specially mentioned).

The following tabulation gives the number of accidents reported from August 4, 1914, to November 11, 1918, and the casualties involved:—

Accidents causing death or injury	Men		Women		Accidents not causing death or injury
	Killed	Injured	Killed	Injured	
733	271	745	54	571	544

Giving the following totals:—

Accidents	Killed	Injured
1,277	325	1,316

During the same period the maximum number of workpeople employed amounted to 86,555, the average number being 61,808.

These figures show a net result of 1·25 persons killed and 5 injured per 1000 per annum. Points of interest in this connexion are (1) the proportion of accidents causing no personal injury to the total number, *viz.*, 544 to 1277, especially remarkable in the case of accidents with detonators of which less than half caused personal injury; (2) of the 325 deaths 177 were due to TNT, picric acid and dinitrophenol, which prior to the war were regarded as comparatively free from danger; (3) the small number of deaths in gunpowder manufacture, *viz.*, 7; (4) the absence of any fatal accident in filling over 8000 millions of small arms cartridges; (5) the danger of incendiary and firework compositions containing aluminium powder.

The Trade of Western Samoa, The Tongan Islands, and The Fiji Islands. *By* Mr. R. W. Dalton, *H.M. Trade Commissioner in New Zealand.* [Cmd. 200—4*d.*, and Cmd. 201—3*d.*]

Western Samoa consists of a group of islands about 600 miles from Fiji, which were formerly under German influence but are now under Allied control. The soil is very fertile, the chief production being copra; but cacao and rubber have been grown with some success. There is still a very large area of uncultivated land and if this is developed a very prosperous future lies before the islands, although the natives are not inclined to work continuously either for themselves or an employer.

Before the war the major part of the Samoan trade was in the hands of the Deutsche Handels und Plantagen Gesellschaft, a large Hamburg firm operating in the South Seas. Since the military occupation the firm's trading operations have been suspended but the plantations have been carried on by a liquidator. Of the other white firms there are four British, and two each of American and Danish origin. The import trade in recent years has

been: 1912, £249,720; 1914, £236,239; 1915, £267,091; 1916, £178,840. From the published returns the 1916 trade appears to have been divided as follows:—New Zealand, 39%; Australia, 34%; United States, 19%; United Kingdom, 3%; but these figures are somewhat misleading as New Zealand and Australia ship a lot of goods which originate in Britain. The chief imports are provisions, cloth piece goods and hardware. Samoan merchants have recently established buying agents in San Francisco and so brought American competition into these markets, while the Japanese have begun to compete in cheap goods formerly supplied by Germany.

The export trade for 1916 amounted to £235,415, made up of copra £143,245, cocoa £63,970, rubber £20,228, hides £690, and papain £608. During the war the copra has nearly all gone to the United States owing to difficulties of shipping elsewhere, and the continuation of this business is likely to be a serious handicap to British trade interests. Much British trade is done through Sydney and Auckland, but it seems quite clear that British firms have not taken the direct interest in the Islands which they might have done. The future development of Samoa depends largely on a satisfactory solution of the labour problem. The German firm above-mentioned used labour from the Solomon Islands. The importation of Chinese is at present handicapped by the high cost of repatriation. With sufficient labour, it is estimated that some 80,000 acres of fresh land could be cultivated. The coconut and cacao crops have suffered from the attack of the rhinoceros beetle and canker, and scientific investigation of these two pests is greatly needed.

The Tongan Islands are about 400 miles from Fiji and 360 miles from Samoa and form a British Protectorate. The conditions of the natives and of trade generally are very similar to those already described for Samoa, but the trade, both import and export, depends almost entirely on the copra crop. The islands are very low lying and are frequently visited by hurricanes which do great damage to the coconut palms. The trade for the last six years has been as follows:—

Year		Exports Copra	Exports Total	Imports
1912	...	£209,567	£216,511	£169,473
1913	...	72,480	82,320	81,044
1914	...	67,304	73,036	87,702
1915	...	102,900	103,950	100,075
1916	...	26,360	32,520	48,428
1917	...	122,333	125,442	114,290

Messrs. Lever Bros. and Messrs. Burns, Phelp & Co. now do most of the outward trade in copra, and a great deal of the trade is apparently already British, but our manufacturers could get a larger share by studying local requirements. The chief points in considering the future of the Tongan Islands are (*a*) the attitude of native labour, and (*b*) the need for some alternative products which will form a means of sustenance during the bad copra seasons.

The Fiji Islands include over 250 islands about one-third of which is inhabited. The total trade in 1917 amounted to £3,079,809 (imports £1,011,408 and exports £2,068,401). By far the most important product is sugar which forms over 70 per cent. of the exports, but copra is also important. The use of cattle as weeders in the coconut plantations has been successfully adopted and cattle raising is likely to form a considerable industry. The natives are of a similar type to the other South Sea Islanders, and in the past labour has been obtained by the importation of indentured Indians. The indenture system has now been abolished and the future position as regards labour is obscure. The import trade of 1917 was distributed between:—Australia, 52%; New Zealand, 17%; United Kingdom, 12½%; United States, 6½%; Japan, 2%; a large amount of the Australian and New Zealand trade consists of transhipments from Britain. Leaving Australasia to supply provisions, and United States to send oils etc., it is estimated that the United Kingdom can compete in the import trade up to £560,000 annually, in such goods as hardware, sugar machinery and cloth piece goods. The British share of the trade before the war was very large and a good deal of that which has been lost during the war will revert to Great Britain automatically when conditions again become normal. The future extension of trade, however, depends entirely on the labour problem; and if this is not satisfactorily solved it will not be necessary to attach any particular importance to trade with Fiji.

COMPANY NEWS.

BRITISH DYESTUFFS CORPORATION, LTD.

The statutory report states that in addition to the shares allotted to the amalgamating companies, there have been issued for cash 850,000 preference shares and 850,000 preferred ordinary shares (registered in the names of the nominees of H.M. Government). Receipts amount to £3,679,186, and disbursements include £125,000 underwriting commission and £1,710,125 paid to the amalgamating companies to enable them to discharge outstanding liabilities, etc., leaving a balance of £1,837,497.

At the statutory meeting held in London on August 26, Sir Henry Birchenough, who presided, said that 3,276,000 shares, or approximately two-thirds of the total issue, had been applied for by the public. There were now about 12,000 shareholders on the register. The item of £225,000 for preliminary expenses was largely made up of registration fees and stamp duty (£130,000), and brokerage (£60,000); the underwriting commission was 2½ per cent. There was every reason to believe that with the loyal co-operation of the textile industry, the corporation would be able to satisfy the requirements of this country, those of important consumers throughout the Empire, more particularly in India, and make a successful fight against German competition in China and other markets.

Lord Moulton stated that small quantities of dyes were being imported from Switzerland. The board had no positive knowledge, but believed that no German dyes were coming into this country by way of America.

RUBBER PLANTATIONS INVESTMENT TRUST, LTD.

At the tenth ordinary general meeting held on August 29, Mr. G. Croll, who presided, said that the total area under plantation rubber was estimated to be 2,750,000 acres at December 31, 1918. When this acreage is in full bearing seven years hence, the output would be approximately 500,000 tons, which is about double the quantity produced in 1918. There should be no fear of supply overrunning demand. In the United States there were over 1,000,000 registered motor cars in 1913, 2,250,000 in 1916, and approximately 6,000,000 at the beginning of the current year. It was difficult to understand why the manufacture of rubber goods in this country had not developed to any great extent; there is a growing demand for such goods at the present time, and the immediate need is for British manufacturers to augment their plant. The Rubber Growers' Association is inviting suggestions for new uses to which rubber might be put.

During the past financial year there was a net loss of £114,075, of which £45,000 was due to loss on exchange. The issued capital of the trust is £1,494,809.

ENGLISH OILFIELDS, LTD.

An extraordinary general meeting was held on September 1 to consider the question of raising the capital to £1,500,000 by the creation of 1,200,000 new shares of £1 each, to rank equally with the existing 300,000 shares. Sir James Heath presided.

Dr. W. Forbes-Leslie, dealing with the technical aspect of the undertaking, said that the company was founded in 1918 to acquire the interests of the English and Foreign Oil Finance, Ltd., including 20 square miles of land which had been especially marked out by geological investigation. Nineteen bore-holes had been sunk and evidence obtained of the existence over the whole area of oil shale seams having a thickness of retortable material of not less than 150 ft. and being remarkably uniform both in thickness and in oil content. Several of the borings had passed through some 70 ft. of a substance which yields a large percentage of wax—the so-called ozokerite of Norfolk.

Mining operations were started six months ago, and No. 1 Mine West Winch is capable of giving an output of 500 tons per day. Mining in the shale series is economical and samples from the mine faces show a 50 per cent. greater yield of volatile matter than was given by the bore-hole samples. The oil obtained from the middle shales is of remarkable quality, practically free from sulphur and gives high yields of motor spirit and wax. Dr. Forbes-Leslie estimates that these shales contain more than 2,000 million tons of practically sulphur-free material, which would yield 45—50 galls. of oil, at least 60 lb. of ammonium sulphate, and 60 lb. of wax, per ton. A long series of tests on the best form of retort had led to the selection of a new type which, subject to certain minor alterations, should give satisfactory results. Adjoining the mines is a 40 ft. deposit of blue clay extending over 161 acres, from which bricks, second to none in England, can be manufactured. The shale residues have been found to be suitable for cement manufacture. The chalk required for this purpose occurs abundantly on the property and the waste gas from the retorts will be available for fuel. It should be possible to produce 600 tons of cement daily when the projected 1000-ton shale plant is in operation. The property owned by the company is capable of supplying 18 works each dealing with 4000 tons of shale per day.

The resolution to increase the capital was carried unanimously.

AMMONIA SODA CO., LTD.

The report and accounts for the year ended January 31, 1919, show a trading profit of £43,139, and, after deducting excess profits duty, etc., a credit to profit and loss of £35,194. Out of this sum it is proposed to pay the preference dividend of 6 per cent. for the year, to write off the suspense account of £15,000, and to carry forward £15,036. The subscribed capital is £217,978.

Soon after the termination of hostilities it was found to be impossible to manufacture without incurring heavy loss, owing to increased costs, decline in the market price of the material manufactured, decreased demand, and to the bad state of the plant. In March last it was decided to suspend work and to overhaul the plant. In the result the directors, in consultation with the chief shareholders, resolved upon voluntary liquidation. This course has been agreed to by the shareholders.

OFFICIAL TRADE INTELLIGENCE.

(From the Board of Trade Journal for August 28 and September 4.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 73, Basinghall Street, London, E.C. 2, from firms, agents or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

Locality of Firm or Agent	Materials	Reference Number
Australia ...	Glassware, stoneware ...	502
,, ...	Colours, earthenware, tiles	554
British India ...	Galvanised sheets, pitch	504
Canada ...	Carbon paper, inks ...	558
,, ...	Superphosphates, basic slag, Paris green, lead arsenate, calcium arsenate, potash, vinegar, matches, polishes ...	*
Egypt	Galvanised sheets, asbestos roofing, bituminous paints ...	515
,, ...	Dyes, soap, glass, earthenware, paper	559
Austria	Drugs, medicines ...	516
Belgium	Cast steel, cast iron chilled rolls	517
,, ...	Chemicals, dyes and acids for textile industry ...	521
,, ...	Tinplate	525
,, ...	Chemicals, drugs, laboratory requisites ...	565
,, ...	Chemicals for dyeing, glue	566
Czecho - Slovakia	Chemicals, paints (catalogues of)	†
Denmark ...	Pig iron	531
Esthonia	Petroleum, chemicals, medicines, caustic soda, iron, glue, quebracho, lubricating oils (goods in demand)	—
France	Drugs, fine glassware ...	533
,, ...	Hides, leather	570
Germany (Occupied Territory)	Iron, steel	574
,, ...	Oils	575
Italy	Zinc	‡
Rumania ...	Chemical and pharmaceutical products ...	577
Turkey	Glass, soap, perfumery, chemicals	540
,, ...	Glass, china, paint, etc. ...	541
Argentina ...	Dyes	544
Brazil	Cement, paint, varnish, glass, earthenware, chemicals, drugs, perfumery	585
,, ...	"Granite" earthenware	586
Chile	Aniline dyes	587
Peru	Glass, earthenware, paper, perfumery ...	549

* High Commissioner for Canada, 19, Victoria Street, S.W. 1.

† Chambers of Commerce (Export Department) at Prague, Budweis, Olomouc, Brno, Opava, Eger, Reichenberg, Pilzen, Bradec-Kralove, Bratislava, Kosice, or Troppau in Silesia.

‡ British Chamber of Commerce for Italy, via Silvio Pellico, 12, Milan.

Markets Sought. *Ceylon.*—Requirements of rubber manufacturers, of consumers of copra, cinnamon, citronella oil and desiccated coconut, and of buyers of plumbago.

Canada.—High grade felspar, phosphate and pyrites.

TARIFF. CUSTOMS. EXCISE.

United Kingdom.—The preferential duties on certain articles, including sugar, glucose, syrup and saccharin, came into force on September 1. The regulations are set out in the issues of the *Bd. of Trade J.* for Aug. 28 and Sept. 4.

Australia.—The import duties on certain dry colours have been amended.

Canada.—Recent customs decisions affect benzol, xylol, solvent naphtha and salt. The export of raw hides, skins and leather for boot manufacture has been prohibited, except under licence, as from August 2

Chile.—Particulars of a recent decree regarding the payment of customs duties are given in the *Bd. of Trade J.* of Aug. 28.

Federated Malay States.—The rates of import duties on alcoholic liquors have been revised as from July 4.

France and Algeria.—The production, importation and sale of alcohol is reserved to the State until a law establishing a temporary or permanent régime for alcohol is passed, or at the latest until six months after the conclusion of hostilities.

French Guiana.—A statistical tax has been imposed on all goods, with some exceptions, imported from or exported to, all countries as from August 11.

Hayti.—A statistical tax has been imposed on, *inter alia*, hides, sugar, wax, alcohol and guano.

Italy.—For the present the new import restrictions do not apply to goods sent by parcel post except in certain cases. Goods so imported are still subject to import licence.

Jugo-Slavia.—Certificates of origin are required for goods imported, but it is not necessary that they should be *viséd* by a Serbian consul.

Rumania.—The articles the importation of which is prohibited except with the consent of the Minister of Commerce and Industry includes certain kinds of glass and porcelain, fine skins, toilet soap, cocoa, chocolate and paper.

Sierra Leone.—The import duties on alcoholic beverages have been increased as from July 16.

South Africa.—The customs duty on medicinal and toilet preparations, essences, tinctures and syrups containing more than 3 per cent. of proof spirit has been fixed at £1 11*s*. per imperial gallon or 25 per cent. *ad val.*, whichever shall be the greater.

South Russia.—A customs duty of 10 per cent. *ad. val.* has been imposed on all goods, with some exceptions, including starch, salt, vinegar, fats and oils, glycerin, many chemicals, minerals and ores, certain metals, asbestos, rubber, clay, lime, and tanning materials.

Sweden.—Amongst the articles the export of which is still forbidden are minerals, colours, bitumen, asbestos, asphalt, animal fats, starch, oil cake, many articles of food, hides, skins, bones, hair, vegetable fibres, rubber, metals, mineral oils, vegetable oils, wax, glycerin, candles, soap, and many chemicals.

United States.—It is proposed to amend the customs duties on laboratory and optical glass, and on scientific instruments.

GOVERNMENT ORDERS AND NOTICES

SULPHATE OF AMMONIA.

New Maximum Prices.

The Board of Agriculture has come to an agreement with the makers of sulphate of ammonia in regard to the maximum prices to be charged for this fertiliser for home agricultural use for delivery in the eight months October 1919—May 1920. These prices are appreciably higher than those ruling during last season, owing to the fact that the Government subsidy given to makers during the war has now been withdrawn. The agreed maximum prices are fixed on a commercial basis which has to cover the substantial increases that have occurred since last year in the cost of coal, wages, and raw materials. The Board considers that these prices are not more than are necessary to secure to the manufacturers a reasonable trade profit.

For sale in lots of not less than 2 tons for delivery by rail or water to purchaser's nearest railway station or wharf in Great Britain, less a trade discount to agricultural merchants, dealers and co-operative societies, the agreed maximum prices are :—

Month of delivery	Price per ton, in bags, net cash
October, 1919	£20 10 0
November	20 15 0
December	21 0 0
January, 1920	21 7 6
February	21 15 0
March, April and May	22 0 0

In the case of deliveries to Ireland, Isle of Man or Channel Islands, the prices include delivery f.o.b. port in Great Britain.

The above prices are for 24·5 per cent. ammonia, and will be increased by 4*s*. per ton for each complete 0·25 per cent. ammonia over 24·5 per cent., and by a further 5*s*. per ton if sellers guarantee the free acid not to exceed 0·25 per cent.; and should be reduced by 4*s*. per ton for every 0·25 per cent. ammonia below 24·5 per cent. The qualitative increases and reductions apply only to deliveries of 2 cwt. and over. If the sulphate is specially ground or pulverised at buyer's request, an additional charge not exceeding 5*s*. per ton may be made.

Certain extra charges are allowed for deliveries of less than 2 tons.

SUPPLY OF HIGH GRADE POTASH FOR AGRICULTURAL PURPOSES.

The Government has recently acquired from Germany a quantity of potash salts in exchange for food, and arrangements have been made for the distribution of about 40,000 tons for agricultural purposes. The sale of the material will be undertaken by the British Potash Co., Ltd., 49, Queen Victoria Street, London, E.C. 4, under the direction of an Official Committee, to be called the Potash Distribution Committee, on which the Board of Trade and the Departments of Agriculture for England, Scotland and Ireland will be represented, together with representatives of trade interests.

The following maximum selling prices have been agreed for sales to farmers, delivered to nearest railway station in Great Britain or Ireland in lots of not less than 4 tons: Potash salts 30% K_2O, muriate of potash 80% KCl, £20 12*s*. 6*d*.; sulphate of potash 90% K_2SO_4, £23 2*s*. 6*d*.

Manure mixers, merchants, dealers and co-operative societies will be allowed a discount on these prices of 7*s*. 6*d*. per ton on potash salts, and 10*s*. per ton on the muriate and sulphate of potash.

The potash will be sold at the above basis prices, and a proportionate increase or decrease will be made for higher or lower quality as shown by analysis of a representative sample of each consignment.

For sales of small quantities *ex* merchants' store certain maximum additions to the above prices are allowed by the Board.

No potash of a lower grade than 30% Salts is available under the above arrangement, but licences are being granted to the Alsace-Lorraine Trading and Development Company, 54, Gresham Street, London, E.C. 2, for the importation of 20,000 tons in all of kainit (14% K_2O) and sylvinite (20% K_2O), to whom purchasers should apply.

EXPORTS.

Export credits.—The Government is prepared to consider applications for advances up to 80 per cent. of the cost (plus freight and insurance) of goods sold to:—Finland, the Baltic Provinces, Poland, Czecho-Slovakia, Jugo-Slavia, and certain areas in Russia. Applications to the Export Credits Department, 10 Basinghall Street, E.C. 2.

IMPORTS.

Mineral oils.—The general licence covering kerosene and benzine (including white spirit) gas oil and fuel oil refers to total quantity of import, and does not affect the arrangement with the Pool Board whereby the number of importing firms is limited. This arrangement ceases on October 31, after which date other firms will be allowed to import.

Opium and cocaine.—The importation of these drugs remains prohibited, except under Home Office licence, in accordance with the provisions of Article 295 of the Peace Treaty.

Paper.—All articles covered by the Regulation as to the importation of paper are to be admitted into this country as from August 29.

Transport of coal.—The Board of Trade has notified that the restrictions on the transport of coal by rail imposed under the Coal Transport Reorganisation Scheme are suspended as from September 1.

TRADE NOTES.

BRITISH.

Leeward Islands in 1917-18.—Owing to difficulties in obtaining sufficient supplies of Sea Island cotton for aeronautical purposes the British Government decided in October 1917 to acquire the whole of the production of these islands at the following prices:—Ordinary, 3*s.* per lb.; good ordinary, 3*s.* 4*d.* per lb.; superfine, 3*s.* 9*d.* to 4*s.* 7*d.* per lb.

The principal exports of the colony in 1917 were:—

	£	Percentage of total exports
Vacuum pan sugar ...	£477,031	43·6
Muscovado sugar ...	121,559	11·1
Molasses and syrup ...	58,413	5·3
Cotton, raw	78,460	7·1
Limes, citrate	6,930	0·6
,, concentrated ...	58,554	5·3
,, raw juice ...	84,528	7·7
,, cordial	103	—
,, fresh	48,454	4·4
,, pickled	403	—
Cocoa	8,239	0·8
	£942,674	85·9

Antigua.—A little more than half of the sugar exported from the colony came from Antigua, where the total quantity of canes dealt with during 1917 was 102,593 tons. The work of the factories was even more satisfactory than in the previous year. The sucrose left in megass was 3·01% in 1916 and 2·66% in 1917, the purity of the juice 83·95% and 84·78%, and the yield of sugar was increased from 11·01 to 11·42%. This improvement in the recovery of sucrose in the factory, as compared with the average of the five years immediately preceding the war, is calculated to be equivalent to an increase of 2¼ tons of cane per acre.

Dominica.—This island is the chief producer of lime products. The crop in 1917 was 396,000 barrels (of 4·55 cub. ft.) of fruit, compared with 384,000 barrels in 1917. The disposal of the crops is shown in the following table:—

Product	Barrels of fruit	Percentage of total crop
Concentrated juice ...	224,662	56·7
Raw juice	103,751	26·1
Fresh limes	41,243	10·4
Citrate of lime ...	26,068	6·6

The lime crop has been practically the same during each of the last five years. This lack of progress is largely due to the effect of the hurricanes of 1915 and 1916, and also to the increased cost of labour and the difficulty of obtaining supplies of concentrated manures.

Montserrat.—The export of lime products in 1917 was 200,000 galls. of raw juice, compared with an average of 134,384 galls. in the four previous years. Exports of muscovado sugar decreased from 417 tons in 1916 to 294 tons in 1917 owing to the shortage of labour caused by the boom in cotton cultivation.

The area under cotton cultivation was 2,608 acres, and the average production at the rate of 157 lb. of lint per acre, or 11 lb. per acre above the average for the past 14 years. High prices were maintained, and the outlook for the future is very hopeful.

The experimental work of the Agricultural Department has shown that the ajowan plant can be cultivated as a source of thymol, and some interest has been aroused in the cultivation of a local plant, *Datura Metel*, as a source of the alkaloid scopolamine.—(*Col. Rep. Ann.*, *No.* 992, *May* 1919.)

FOREIGN.

Japanese Foreign Chemical Trade.—The values of the chemicals, including explosives, imported into Japan have undergone continuous expansion in recent years. Thus the value imported increased from 20,012,802 yen in 1910 to 55,429,809 yen in 1916, representing an increase of from 5·9 to 7·3 per cent. of the total imports of all kinds into the country.

The relative positions of Germany, the United Kingdom and the United States in regard to the supply of chemicals to Japan during the period 1912—1916 may be gauged from the following statistics (yen = 2*s.* 0½*d.*):—

Value of Imports into Japan (in thousands of yen).

Substance	Year	Germany	U.K.	U.S.A.
Boracic acid	1912	92·6	24·4	1·3
,, ,, ...	1914	59·4	23·6	9·8
,, ,, ...	1916	10·0	242·5	129·7
Tartaric acid	1916	—	45·3	57·1
Salicylic acid	1914	170·2	—	5·2
,, ,, ...	1916	12·7	—	209·0
Carbolic acid	1014	139·4	37·4	65·0
,, ,, ...	1916	28·2	1·5	3665·6
Citric acid	1914	28·9	25·7	64·0
,, ,, ...	1916	·9	49·6	66·1
Caustic soda	1912	—	1162·8	3·7
,, ,, ...	1914	—	1291·8	116·9
,, ,, ...	1916	—	435·5	2489·3
Soda ash	1912	—	1388·0	0·2
,, ,, ...	1914	—	1485·2	45·2
,, ,, ...	1916	—	2936·9	70·7
Bicarbonate of soda* ...	1914	—	290·0	0·03
,, ,, ...	1916	—	330·2	36·5
Borax	1912	55·8	51·7	33·7
,, ...	1914	16·8	94·7	24·1
,, ...	1916	2·6	429·9	209·5
Potassium chlorate† ...	1912	412·8	234·7	0·8
,, ,, ...	1914	277·2	178·1	10·0
,, ,, ...	1916	14·2	397·8	850·3
Ammonium sulphate* ...	1912	—	12,011·7	—
,, ,, ...	1914	—	14,992·1	—
,, ,, ...	1916	—	511·3	—

* Increasing quantities of those materials have been imported from Manchuria (in 1916, bicarbonate 27·4, ammonium sulphate 284·4).

† Tho values of chlorate imported from France wore 501·3 in 1912 and 312·3 in 1916.

Prospects of American Dye Trade in the Far East.—The dyestuff market in the United States is likely to remain firm for at least a year and German competition is not to be feared for another two years. Germany's stock of dyes is probably very much less than has been stated, and her difficulties in regard to labour costs, taxes and overhead standing charges (due to restricted production) will all be higher than in other countries.

With regard to the market in China, the chief difficulty manufacturers have to contend with is the conservatism of Chinese merchants. The unfounded rumour, current after the armistice, that large quantities of German dyes would be available at pre-war prices proved all but disastrous to American trade. Germany has almost insuperable difficulties to contend with in regard to transportation as well as production, and under these circumstances America will be able to compete both in quality and price. The question of credits is important, but American banks in China are giving great assistance. The pre-war German selling organisations are still intact, and what is now needed is American control of one or more large native dealers.

The Dutch East Indies offer great possibilities. Germany maintained experts in Java to give instruction in the use of German colours, and as these men have been unable to leave, she has an organisation ready for her post-war trade. German agents allowed long credits and were permitted to make their own arrangements as to payment. Prospects in Japan are also bright. German agencies are now in the hands of Japanese dealers. Little Government protection is offered to the dye-making industry, probably on account of fear to inflict injury on the established piece-goods industry. Direct sales are unfavourable in Japan where it is customary for small dealers to buy through the larger houses.—(*U.S. Com. Rep., July* 21, 1919.)

The Tin Mining Industry in Yunnan.—The production of tin in Yunnan province, China, has almost collapsed, the production having fallen to 2500–6000 tons this year against 12,000 tons for last year. Although more transport has been available than usual, the prices have been constantly falling, 99% metal being quoted at $84 per picul of 133 lb., 98% at $83, and 96% at $77 in local currency against normal prices of $95 to $105. There is little chance of recovery and many miners have gone to other work.

Exports of the metal from Hong Kong this year amount to 2111 short tons of value $2,353,640, practically all of which has gone to China itself. Stores of approximately 3000 tons are in hand in Hong Kong. The serious factor is exchange, the high price of silver preventing Yunnan tin competing with tin from the Straits Settlements.—(*U.S. Com. Rep., July* 9, 1919.)

The Sulphur Situation in Sweden and Norway.—The pre-war consumption of sulphur in Sweden amounted to 40,000 tons yearly, all of which was imported. The bulk was used in the sulphite wood pulp industry and was obtained from Great Britain and Sicily. At present there are prospects of America and Japan entering this market. During the war the majority of the pulp mills has been re-adjusted so as to utilise Norwegian pyrites in place of sulphur and this introduces further competition. Consumers are not likely to consider any price above about £9 per ton c.i.f. Sweden.

Before the war the requirements of the sulphite wood pulp industry in Norway were largely met by imported sulphur and the native pyrites was mostly exported. During the war this state of affairs has been altered and the majority of the pulp factories has been adapted to use pyrites. This change is reflected in the statistics. There has been an increase in the production of pyrites from 369,055 tons in 1911 to 513,335 tons in 1915 (the latest record available) but a decrease in exports from 360,228 tons in 1914 to 240,774 tons in 1918, the differences being accounted for by the increased home consumption. The sulphur imports have during the same period fallen from 15,411 tons in 1913 to 3,036 tons in 1918. The bulk of the sulphur imported previously came from Great Britain, Italy and Spain, but latterly Spain has been shipping far less than formerly, and in 1918 the United States furnished more than half the total imports imported.

The price of sulphur up to 1914 was fairly constant at 90 to 95 kroner (£5—£5 5*s.*) per ton, but since then it has increased by stages up to 300 kroner (krone = 1*s.* 1½*d.*). It is estimated that the normal demand for sulphur is about 7000 tons per annum (about 5000 to wood pulp works and 2000 to match factories and minor industries), but the present situation is very unsettled largely owing to the difficulties experienced by the sulphite mills in disposing of their products.—(*U.S. Com. Rep., July* 14, 26, 1919.)

Prices of Sulphuric Acid and Nitrogenous Fertilisers in Germany.—The price of sulphuric acid, as authorised on April 1, has been further increased as from July 1. The price of sulphuric acid containing up to 78% of the monohydrate is increased from 510 to 578 marks per 1000 kilo. sulphur content. For acid containing between 78% and 92% monohydrate the price is advanced from 1000 to 1069 marks, a deduction up to 125 marks per 1000 kilo. being allowed according to the quality delivered. The price of sulphuric acid of strength above 92% and of oleum containing up to 40% free SO_3 is advanced from 684 to 753 marks. The price of acid of unspecified strength is fixed by the addition of a suitable increment to the cost of production.

An increase in the price of nitrogenous fertilisers has been authorised by a decree of the Reichwirtschaftminister, the operation of the decree to be retrospective as from July 1, 1919. The current prices thus established show considerable advances on those ruling on March 16 of this year, the respective prices being as given in the following table:—

Price per kilogram % nitrogen.

	Present Price Pfg.	Former Price Pfg.
Ammonium Sulphate:		
(a) Ordinary manufacture ..	290	180
(b) ditto, dried and ground ..	296	186
Sodium ammonium sulphate ..	290	180
Ammonium nitrate	340	200
Potassium ammonium nitrate ..	340	220
ditto, per kilo. potash content ..	+48	+41
Sodium nitrate	340	275
Calcium cyanamide	140	140
Blood meal	260	260
Phosphate meal	220	220

The following prices per kilo. are likewise authorised: ammonium chloride 2·90 marks, sodium, ammonium nitrate mixed with from 40% to 48% of rock salt, 3·40 marks, ammonium nitrate containing a minimum of 3% bone meal 3·40 marks, ammonium nitrate mixed with either calcium sulphate or lime (containing about 40% gypsum or lime) 3·40 marks. Another decree places the prices of nitrogenous fertilisers on a uniform basis by increasing the prices of 9 nitrogenous fertilisers (compared with 5 formerly) by 1·00 mark per kilo. of nitrogen (formerly 0·80 mark) and the price of calcium cyanamide by 2·00 marks (previously 1·00 mark).—(*Z. angew. Chem., July* 15, *Aug.* 1, 1919.)

Water Power in German-Austria: Proposed Carbide Monopoly.—Until now water-power installations have been adapted to the supply of water available with certainty during nine months of the year; but it would be better if they were enlarged so that the greatest quantity of water available at any time could be utilised. A steady supply of energy should then be delivered at a high price during the whole year to the consumers of light and power, whilst the excess, available only from time to time, would serve for selected chemical factories using only cheap current and making a product easy to be stored and not requiring further treatment. The manufacture of calcium carbide, which could be carried on intermittently, fulfils these conditions, and it would be possible to make 6,500,000 tons of this material from the 500,000 metric tons of gas-coke annually produced in German-Austria. The necessary electrical energy (5·76 million kilowatt-hours) could be provided by the excess energy of the enlarged water-power stations, and the cost of electrical power would be reduced to all consumers. Carbide, to the value of 910 million kroner per year, could be produced and at a much lower cost than obtains in most other countries. This industry is well suited to be a State monopoly.—(*Z. angew. Chem., June* 17, 1919.)

Foreign Company News.—*France.*—The "Société Française de Radio Chimie" was established early in 1914 with a capital of 1,700,000 francs. Its operations were devoted to the working up of monazites and other radioactive earths with a view to the production of mesothorium, radium and its various transformation products. It devoted particular attention to the production of luminous and pharmaceutical radium products and has succeeded in introducing its products into several markets formerly supplied by Germany. A net profit of 251,817 francs enables a dividend of 10 per cent. to be declared.—(*L'Information, June* 12, 1919.)

Dutch Indies.—A firm of chemical manufacturers about to be established in Soerabaja will be primarily concerned with the production of carbon bisulphide, which is indispensable to the tobacco industry; the output will at first be 1,000 kilo. per 24 hours, so that Java will be in an independent position as regards uncertain import conditions.—(*Z. angew. Chem., July* 18, 1919.)

OBITUARY.

Dr. A. G. Vernon Harcourt.

Dr. Augustus George Vernon Harcourt, who was born in London on December 24, 1834, died at St. Clare, Ryde, on August 25 last. As an undergraduate he studied under Dr. Daubeny and Henry Smith (Oxford's earliest teachers of chemistry), and in 1858 became lecture assistant to Sir Benjamin Brodie, who in October of that year delivered his first course of lectures as professor of chemistry in the new Science Museum which heralded the recognition by Oxford University of the educative value of natural science. Associated thus with the inception of the teaching of chemistry at Oxford, Harcourt was appointed in 1860 Lee's reader in that subject at Christ Church, and in the small laboratory of that college he continued until 1902 to initiate successive half-scores of undergraduates in the principles of chemistry. Himself a classical scholar of no mean standing, he nevertheless very actively supported the movement to abolish compulsory Greek in the curriculum of students of natural science at Oxford University.

Harcourt's early researches were on the rate of chemical change, for which his exceptional skill as an analyst stood him in good stead. His technical work was largely in connexion with gas supply, and he laid the foundations of the Carpenter-Evans heating process for the purification of coal gas from carbon bisulphide. He studied other gas purification problems, and devised a useful works' method for estimating the sulphur compounds in gas. He worked for over 20 years at the production of a standard of light which should be more trustworthy than the parliamentary standard candle, and in 1897 produced the 10-candle pentane lamp which goes by his name, and is now the accepted international standard of light. He invented a chloroform inhaler which reduces to a minimum the risks inseparable from the administration of that anaesthetic. He strongly advocated the use of coke in place of coal as a household fuel, and devised special labour-saving grates for its consumption. Harcourt was, with Arrhenius, the first to receive a science degree (in 1908, *honoris causa*) from Oxford University. He also received honorary degrees from Durham and McGill Universities. Elected to the Chemical Society in 1859, he was one of its secretaries from 1865 to 1873, and, after three terms of years as vice-president, became president for three years—1895-7. He gained his F.R.S. in 1868. For a period of 45 years—1872 to 1917—he was appointed and re-appointed by the Board of Trade one of the Gas Referees for the Metropolis.

REVIEWS.

The Chemistry and Manufacture of Hydrogen. *By* P. Litherland Teed. *Pp.* 152, *with* 22 *illustrations.* (*London: Edward Arnold,* 1919.) *Price* 10*s.* 6*d. net.*

Although the manufacture of hydrogen has long been carried out on a relatively small scale, it is only during the present century that plants for its extensive production have been developed, to comply with the demand for the gas, more especially for use in the hardening of fats, for use in airships, and for the synthetic production of ammonia by the Haber process. While much information on the subject is to be found in Patent Specifications, and scattered through the technical journals, there has hitherto been no book of recent date dealing with the subject available for those interested in chemical technology generally desiring information on the subject. The lecture given early in 1914 by Prof. A. W. Crossley (this J., 1914, **33**, 1135) and C. Ellis's book on the "Hydrogenation of Oils, Catalysers and Catalysis, and the Generation of Hydrogen" (Constable, 1914) are, so far as the writer knows, the only general sources of information on the subject, but since the year 1914 a very great development of the manufacture has taken place, owing to the largely increased demand for hydrogen for the above purposes arising from the war.

This gap in the literature Major Teed has endeavoured to fulfil in the book under review, and he has succeeded in writing a very readable description of the various processes in use and of suggested possible technical processes. These include not only the processes directly devised for production of hydrogen as the primary product, such as the silicol, the water-gas, and Bergius processes, but also those in which hydrogen is obtained as a by-product, such as the production of caustic soda by electrolysis. In addition to being readable the accounts given are also clear and generally accurate, and the illustrations are not too small or too overloaded with detail to enable them to be followed, as is too frequently the case in books

of this class. It is true that definite statements occasionally occur with regard to matters of detail which would not meet with anything like universal agreement from those engaged in the industry, but this is almost impossible to avoid in a short work dealing with the matter generally, and not intended to be an exhaustive handbook.

Very few typographical errors occur, those noticed being confined to misspellings of proper names—for example, "Neuman & Strienz" for "Neumann & Streintz" (p. 15) and "Moisson" for "Moissan" (p. 19). H. G. Colman.

The Manufacture of Varnishes and Kindred Industries. *Vol. I. The Crushing, Refining and Boiling of Linseed and other Varnish Oils.* A. Livache *and* J. G. McIntosh. *Third edition, revised by* C. Harrison. *Pp. viii* + 498. (*London: Scott, Greenwood & Son,* 1919.) *Price* 17*s.* 6*d. net.*

This book affords yet another instance of the minute specialisation which is now to be found in every branch of chemical industry. It is the first volume of the third edition of Livache and McIntosh's "Drying Oils and Varnishes," and devotes nearly 500 pages mainly to linseed oil, without by any means exhausting the subject. In its present form the work has been so developed and adapted to English conditions as to be essentially a new book.

The English author, whose death occurred prior to the publication of this volume, was not only a practical expert in his subject, but was also a man of strong personality, which he has impressed upon his pages. It has therefore been no easy matter for the reviser who has completed the unfinished work to fill up the gaps in the subject matter in such a way as to harmonise with what had been written. On the whole it will be admitted that he has succeeded in his task. He has also adopted the plan, which is a wise one for this edition, at all events, of not interfering with the English author's mode of expression. For the same reason it is necessary to refrain from criticising some of the author's views on subsidiary points, such as his dislike for the metric system, and only to call attention to some of the minor errors connected with the main subject. In a future edition, however, it would be advisable for the editor to bring the nomenclature of such terms as "lezithin," "hydrocarbides" and "oxy" (for "hydroxy) acids," into harmony with the terms in common use.

The first fifteen chapters deal with the general properties of drying oils, and the production, composition, refining, and physical and chemical properties of linseed oil; its adulteration; the manufacture of technical products such as printing inks, blown oils, linoleum and rubber substitutes; the chemistry of the drying process, boiled oils, and paints; whilst the final chapter is concerned with oils other than linseed oil.

The information throughout is of a thoroughly practical character, and the book is one which every technical oil chemist will find of the greatest help in his work. It was perhaps inevitable that the chemistry of oils in general should have been compressed to such an extent as to necessitate frequent reference to general treatises on the subject; but a slight expansion in a few places would have obviated this drawback to a considerable extent, without increasing very materially the size of the book.

Several statements require correction or modification. For example, the statement that "the Maumené number gives parallel results with the iodine absorption results" is only relatively correct. Again, the term "linoleic" acid is very loosely used, being sometimes applied to the mixed liquid fatty acids of linseed oil, in other places (pp. 89, 239) to linolic acid, and in others (p. 86) to linolenic acid.

The subject matter has been brought up to date and the recent work of other chemists is critically considered, but it detracts greatly from the value of the book that no references are given to the original publications, and it is difficult to discover from the text whether the results discussed are old or recent. C. A. Mitchell.

Tables of Refractive Indices. *Vol. I. Essential Oils. Compiled by* R. Kanthack, *and edited by* J. N. Goldsmith. *Pp. vi* + 148. (*London: Adam Hilger, Ltd.* 1918.) *Price* 15*s. net.*

This compilation contains records of the measurements of refractive indices of some 500 essential oils, together with references to the original literature in every case. Thus it is not only a list of essential oils obtained from various sources, both geographical and botanical, but also a useful bibliography of the subject.

In the introduction and preface, the author and editor have disarmed criticism by fairly stating the advantages and limitations of the refractometer as applied to the examination of such complex mixtures as natural essential oils, which, unlike simple bodies such as sugar or alcohol in aqueous solution, cannot be quantitatively estimated by any physical method. In the chemical examination of essential oils it is rarely possible to isolate and weigh the valuable constituents; and therefore indirect methods must be employed for the estimation of phenols, esters, alcohols etc., and all evidence, including specific gravity, optical rotation, refractive index, solubility and even odour, must be taken into consideration when deciding whether the sample under examination is to be classed as normal or abnormal. The utility of the "List of References" in these tables is here demonstrated, for it enables the analyst to find out quickly from original papers whether the figures quoted were observed on pure oils of commerce or on oils which could not be described as normal, owing to faulty methods of distillation or unusual sources of raw material used.

The compiler wisely insists upon the importance of quoting the temperature at which an observation is made and indirectly advocates the adoption of some standard temperature or temperatures when making determinations of refractive indices. Alternate pages are left blank for notes. Future editions might with advantage contain an illustrated description of the refractometer and the best methods of using, cleaning and adjusting might be added. The writer can recommend the book to all interested in the examination of essential oils, and at the risk of going beyond his present mandate he would add that a recent examination of Hilger's refractometer side by side with a standard German instrument, using various essential oils as test liquids, has shown it to be much the better instrument, giving sharper definition, more especially from 1·500 and upwards. E. T. Brewis.

PUBLICATIONS RECEIVED.

The Simple Carbohydrates and the Glucosides. *By* E. F. Armstrong. *Third edition. Monographs on Biochemistry. Pp.* 239. (*London: Longmans, Green and Co.,* 1919.) *Price* 12*s.*

Lecture Demonstrations in Physical Chemistry. *By* H. S. van Klooster. *Pp.* 196. (*Easton, Pa.: The Chemical Publishing Co.* 1919. *London: Williams and Norgate.*) *Price* \$2.00.

Grundlegende Operationen der Farbenchemie. *By* H. E. Fierz. *With* 45 *illustrations and* 19 *tables. Pp.* 322. (*Zürich: Schulthess and Co.* 1920.)

THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The excellent attendance of nearly 1500 members at the Bournemouth meeting provided satisfactory evidence that, despite the vicissitudes of war, the British Association has lost none of its hold on scientific men or on those who follow in their wake, "faint yet pursuing." Few will deny that this year's congress was an eminently successful one, scientifically, socially and financially; and in the case of several Sections experienced judges declared that the meetings were the most successful in their recollection.

The work of Section B (Chemistry) was from the point of view of interest at least equal to that of any pre-war meeting of the last decade. Doubtless this was the direct result of the war, since the great majority of the papers dealt specifically with aspects of the science which have risen into prominence during the last four years. But this in itself cannot be considered as the only cause of the large audiences and the marked enthusiasm. It is being gradually realised that if chemistry did not "win the war," it at least contributed very largely to that end, and the importance of science in general, and of chemistry in particular, is now securing public recognition. The interest taken in Section B at Bournemouth certainly shows that the Association is carrying out one of its fundamental objects, to wit, the advancement of knowledge, by inducing those versed in the spirit and letter of science to describe their observations and methods to people who seek knowledge without specialisation; and it was with this express purpose that the organising committee of the Chemical Section arranged a programme which should bring home some of the many activities of chemists during the war. As most of the papers read will appear in due course in the "Review," it is unnecessary here to do more than summarise the subjects with which they dealt. The different aspects of war chemistry referred to were chemical warfare, high explosives, glass, progress in metallurgy, raw materials (Geo-chemistry), and the recovery of spoiled ammunition, while closely related thereto were papers on industrial bacteriology and the preparation of acetone and industrial alcohol. The paper on chemical warfare is to be accorded the honour—shared by only one other paper—of being inserted *in extenso* in the forthcoming Annual Report of the Association; and in connexion with this subject the Committee of the Section passed a resolution urging the Government to make provision for a definitely organised scheme of research on explosives, chemical warfare, and allied physical and engineering problems begun during the war. The report of the Fuel Economy Committee was fully discussed, and excellent papers on pure chemistry were read by Professors Baly, Lapworth and Robinson, and by Dr. Lowry, on chemical reactivity and the mechanism of chemical reactions. By the courtesy of the superintendent, Capt. Desborough, the Section paid a most interesting visit to the Naval Cordite Factory at Holton Heath, Dorset. The inspection of this factory afforded an excellent object lesson in the construction of a chemical works from the point of view of completeness of detail in regard to manufacturing processes and the welfare of the workers.

The Presidential Address of Sir Charles Parsons, and also the address of Prof. Petavel to Section G, should be read by all who are interested in the subject of engineering applied to warfare; and of other sectional presidential addresses, that of Prof. Gray (Section A) dealing with the neglect of science by Government Departments, and that of Sir Daniel Morris to the Botanical Section on tropical agriculture in the Overseas Dominions, are worthy of the attention of chemists. Biochemists will read with interest the remarkable address of Prof. Keith to the Anthropological Section, in which he outlined a new hypothesis to account for the differentiation of mankind into racial types, based on the theory of hormones.

Reverting to the general subject, it may be of interest to recall that the British Association was founded in 1831 under the precidency of Viscount Milton, and that the Rev. W. Vernon Harcourt (president in 1839) was in a large measure responsible for its initiation. The Association can thus look back upon 88 years of active and fertile work in a cause whose importance grows daily more manifest, and whose prosecution still needs all the energy and devotion of its adherents. There are still some who are inclined to look with disdain upon the annual meetings, and to regard them merely as occasions for platform oratory, social entertainments and pseudo-scientific "junkettings"; but the better informed know that the more solid work is done by the Association through the many research committees which are formed under its auspices, and they realise the value of social gatherings for the interchange of ideas. As the reading and discussion of papers dealing with specialised research are now appropriately undertaken by the various individual scientific societies, so the meetings held in connexion with the Association have come to be devoted more especially to the description and elucidation of the broad general lines of scientific advance, and to the discussion of the results, reports and recommendations of the sectional research committees. The valuable work performed by the latter is as little realised by the outside world as is the fact that on account of the small sums available as grants-in-aid (aggregating about £1000 yearly) much of the expense of the investigations falls upon individual members.

Another valuable phase of the work of the Association is the popularising of the achievements and methods of science—an object of perennial importance. Although the annual meetings afford excellent opportunities for the dissemination of such knowledge and for the stimulation of interest, it cannot be denied that considerably more might be done in the direction of publicity. The annual volume issued by the Association is not only expensive but its publication is so belated that its value is reduced to small proportions, and, owing to financial stress brought about by war conditions, many valuable papers and discussions have of late been omitted from its pages. The matter of prompt publication could be remedied immediately, and when the financial position has improved it should be possible to reduce the price of the Annual Reports and to arrange for the issue of cheap reprints of papers and of sectional proceedings. The subject of public lectures, too, upon which Section L (Education) issued a valuable report in 1916, might well be taken up without further delay.

The question of grants in aid of research aroused considerable discussion during the meeting. The lack of sufficient funds for this purpose has been accentuated during the past few years, and the proposal to invite State assistance in respect of grants made by the Association has not met with unanimous approval. However, it is now reported that the principle of accepting grants from the Department of Scientific and Industrial Research has been agreed to; and if no hampering restrictions be imposed, and the Association is allowed to retain the sole right of adjudication, no serious impairment of its freedom should follow the acceptance of such assistance.

Another possible function of the Association is worthy of consideration. At the first meeting in

1831, the Rev. W. Vernon Harcourt proposed that it should "employ a short period of every year in pointing out the lines of direction in which the researches of science should move; in indicating the particulars which most immediately demand investigation; in stating problems to be solved and data to be fixed; in assigning to every class of mind a definite task; and suggesting to its members that here is a shore of which the soundings should be more accurately taken, and there a line of coast along which a voyage of discovery should be made." This suggestion, which apparently was never seriously followed, is of interest and importance at the present time, when the need for inspiring, guiding and co-ordinating research is everywhere apparent. The day has probably gone by when the Association could conveniently and adequately fulfil such functions: so great has been the development in all branches of science that their successful execution can now only be entrusted to the individual scientific societies, or to bodies like the Federal Council for Pure and Applied Chemistry, acting through special research committees. Work of this kind has hitherto fallen to University professors whose spheres of action are necessarily limited; is there not scope for a development of such activities on much wider lines? Material assistance for research has long been a crying need; now that there is some prospect of its realisation, let us not forget that equally necessary, if more subtle, form of assistance which is born of contact with other minds. For in science also, the life is more than meat and the body than raiment.

"MUSTARD GAS."

SIR WM. J. POPE.

$\beta\beta$—Dichlordiethyl sulphide $(CH_2Cl.CH_2)_2S$, was first obtained by Frederick Guthrie (Quart. Journ. Chem. Soc., 1860, **12**, 116), who recognised its powerful physiological effects, and was more thoroughly investigated by Victor Meyer (Berichte, 1886, **19**, 3260) and Clarke (Trans. Chem. Soc., 1912, **101**, 1583). Little importance apparently was attributed to the substance, but our scientific literature recorded that $\beta\beta$—dichlordiethyl sulphide can be prepared by the following series of reactions:

(a) $CH_2:CH_2+HClO=CH_2Cl.CH_2.OH$.

(b) $2CH_2Cl.CH_2.OH+Na_2S=(HO.CH_2.CH_2)_2S+2NaCl$.

(c) $(HO.CH_2.CH_2)_2S+2HCl=(CH_2Cl.CH_2)_2S+2H_2O$.

The above, by order of seniority, may be termed Method 1 for the preparation of this simple organic compound.

Dichlorethyl sulphide was first used as an offensive agent by the Germans during an attack on Ypres in June, 1917; it was immediately identified by the Allies, and became known to the French as "Yperit" and to the British as "mustard gas." The Germans have recently stated that the English diagnosed this offensive material as diethyl sulphide (Chem.-Zeit., 1919, 43, 366), but this statement is doubtless made merely for purposes of propaganda.

We have been told (Zanetti, J. Ind. Eng. Chem., 1919, **11**, 721) that the British gas casualties during July 1917, immediately after the introduction of mustard gas, were almost as numerous as those incurred during the previous years of war. The effects of mustard gas as a military weapon were indeed so devastating that by the early autumn of 1917 the technical advisers to the British, French and American Governments were occupied upon large-scale installations for the manufacture of this material by a process essentially identical with the Method 1 briefly described above. Our technical advisers were, to a certain extent, justified in their adoption of Method 1, because the examination of the German material showed fairly conclusively that Germany was manufacturing its mustard gas by this method.

So much secrecy was preserved in connexion with the project for the manufacture of mustard gas that very few chemists had any knowledge of the scheme of preparation adopted. About the middle of October, 1917, I learnt something of the project, and towards the middle of November, but only upon the urgent insistence of myself and others, our technical advisers consented to my undertaking the task of examining experimentally the preparation of mustard gas.

At the end of January, 1918, the laboratory details of a new method for preparing mustard gas were placed in the hands of the authorities; this, which may be termed Method 2, was worked out by me in conjunction with Mr. C. S. Gibson, and consists in the following reaction:—

$$2CH_2:CH_2+S_2Cl_2=(CH_2Cl.CH_2)_2S+S.$$

This method was entirely novel; no suggestion had been previously made that any such process was possible. Whilst the over-all yield to be obtained from the three-stage process of Method 1 could hardly amount to 60 per cent. of that theoretically possible, the new method gave practically a theoretical yield under the simple conditions laid down in our report. Method 2 was in the hands of our technical advisers—technical chemists, chemical engineers and large chemical manufacturers—early in February, 1918. The purely scientific work practically ended with the discovery of the method and the working out of the optimum conditions for yield, etc., and it was naturally recognised that all further work should be under the direction of the technical men who would be responsible for mass production; after February, 1918, neither I nor any other purely scientific chemist played any part save that of stimulating technical effort and of experimenting on points of minor detail connected with the process. Method 2 was first adapted to emergency mass production by Messrs. Levinstein, Ltd., and this firm was producing within six weeks from the time when it undertook the large-scale installation.

I put forward the above short history with some insistence on dates, because of the criticism advanced by Dr. Herbert Levinstein concerning certain conclusions which I drew in a recent address to the Chemical Society; I do this not from delight in controversy, but because I agree with my friend that "it is important that the facts should be correctly appreciated, as they have a bearing on policy" (this J., 1919, 248T).

Dr. Levinstein tell us (p. 249T) that "there is nothing technically cumbrous in the German process, nor is there any difficulty about it. . . . Our scientific advisers found this process difficult. If they had come straight to the dye industry we could have shown them how to carry out the reaction on the large scale without any difficulty whatever, exactly in the way the German dye industry carried it out. The fact is that the production of mustard gas in England on the other hand remained for too long a prerogative of our scientific advisers." These are remarkable statements. The task of installing on a works scale the German or Victor Meyer process for mustard gas was from the very start in the hands of several of our best known chemical manufacturers. It was never a prerogative of "scientific advisers," and no "scientific adviser" could have found difficulty in the process; the difficulties begin in the works. No dyestuff factory in

Great Britain had had any large-scale experience of either of the three reactions comprised in the German process; further, the most important stage in installing the German method here was entrusted to a great firm of organic chemical manufacturers which is largely interested financially in Messrs. Levinstein, Ltd. Why did not Dr. Levinstein tell his intimate business associates "how to carry out the reaction on the large scale without any difficulty whatever, exactly in the way the German dye industry carried it out"?

Dr. Levinstein's enthusiasm for his life-work is carrying him a little far; surely all is not vanity which does not end in the dye factory. Immediately it was realised that Method 2 had been correctly stated by Mr. Gibson and myself all work on the installation of the German method was stopped in Great Britain, France and America. It is impossible to suppose that the German process could have been put into large-scale operation among the Allies in any reasonable time, and the statement by the American technical chemist Dorsey (J. Ind. Eng. Chem., 1919, **11**, 288) that "the procedure used by Meyer, namely, the chlorhydrin procedure, proved to be unsuitable for large-scale production" must be accepted as correct. The German view on this subject is clear; when the chemical examination of our dud shell put them on to the track of the British process of manufacture they abandoned their own Method 1 and adopted our Method 2 (J. Ind. Eng. Chem., 1919, **11**, 675).

Dr. Levinstein tells us further (p. 248 T) that he disagrees with my deduction (Trans. Chem. Soc., 1919, **115**, 402) that "the German chemical service was inefficient; the scientific chemists under its control were incompetent." He states, however, that "we now know that the German method of making mustard gas had nothing whatever to do with the scientific chemists under the control of the German chemical service." This was precisely my point. The German chemical service was inefficient because it was not doing the work for which it existed; the scientific chemists under its control were incompetent because, whoever they were, they did not protest against the installation of an elaborate and costly process (Method 1) when a little work in the laboratory would have given them the immensely simpler and cheaper British process (Method 2). I venture to think that few chemists who reflect upon the meaning of the three reactions involved in the German method will disagree with my further conclusion, from which Dr. Levinstein dissents, that "it would be difficult to overrate the effects of the skill and perseverance exhibited by the German chemical manufacturer" (*l.c.* p. 402). That he should have been able to produce three hundred tons of mustard gas per month by the large-scale installation of the purely academic Method I constitutes indeed "a significant tribute to the potentialities represented by the large German fine chemical factories."

I have insisted above that Dr. Levinstein is under a misapprehension in supposing that the "scientific adviser" has exerted a paramount influence in connexion with chemical warfare in this country; if he is applying this term to people like myself I can assure him that our function has been strictly confined to telling what we knew or what we had discovered to men like himself—technical and industrial leaders. So soon as it became clear that our scientific investigators had obtained the information required by the manufacturer in connexion with mustard gas they proceeded to the study of another very interesting problem in organic preparation work; this in due course went through Dr. Levinstein's hands, and, as he is well aware, another important advance on German methods of manufacture was achieved.

The complaint is laid by Dr. Levinstein that in my Presidential Address to the Chemical Society I did not specifically "recognise that the success of our mustard gas work was due to the co-operation of the dye industry" (p. 249 T). It should be remembered, however, that I was addressing an intelligent audience well acquainted with those excellent articles from the pen of the professional advertisement writer with which the daily press has been deluged in loud proclamation of the invaluable services rendered to British chemical warfare by this great British industry. My time was limited, and I regarded this knowledge as common property.

For the further satisfaction of Dr. Levinstein's desire that the facts should be correctly appreciated, the addition of a few more details is necessary.

Mr. Gibson and I showed in January, 1918, that the reaction given as Method 2 proceeds practically quantitatively; absorption is slow at ordinary temperatures, attains a maximum at about 60° C., and is hastened by the initial presence of mustard gas. Messrs. Levinstein, Ltd., converted our laboratory method into a successful works process, and performed the absorption at between 30° and 40° C. in order to retain the liberated sulphur in some sort of pseudo-solution. During the transition from the laboratory to the works scale, however, nothing fresh was introduced which was of patentable novelty. The method emerged from the works as what Dr. Levinstein describes as the "Levinstein process" carried out in the "Levinstein reactor," both of which, as Dr. Levinstein truly observes, proved a great success in the United States. My colleague and I used only glass vessels for the absorption of ethylene by the sulphur monochloride, but the "Levinstein reactor" has proved in the past, and will prove in the future, a most valuable adjunct to the resources of the technical chemist. It consists of a cast-iron pot, rather deeper than the ordinary lavatory basin. When the ethylene is blown into a charge of sulphur monochloride contained in the "reactor" absorption occurs with the production of mustard gas. The inventive genius exhibited in the design of the "Levinstein reactor" is in keeping with the great traditions of the British dye industry.

The "Levinstein process" and the "Levinstein reactor" were, of course, handed over to the United States. The Americans were pressed for time, and did not succeed in contributing any new fact to our knowledge of the preparation of mustard gas. They adopted the British method for their large-scale installations, and the Head of the United States Chemical Warfare Service now describes this as the "American method" (Maj.-Gen. Sibert, J. Ind. Eng. Chem., 1919, **11**, 673). So rapid is progress in technical chemistry that the process devised by Mr. Gibson and myself is probably by this time known in Central Europe as the "German method."

It may be of interest, in view of Dr. Levinstein's indictment of British procedure in the connexion under discussion, to point out that "mustard gas" was discovered by a British chemist, that the best method for its preparation was discovered by British chemists, and very rapidly put into large-scale production by a British firm. Further, that the best technical method for the preparation of the necessary ethylene has proved to be that described by a British chemist, Newth, which consists in acting upon alcohol vapour with heated phosphoric acid (Trans. Chem. Soc., 1901, **79**, 915). The only distinction which our country allows to pass to Germany in this matter is that of having treacherously introduced one of the most appallingly toxic substances known as a weapon of civilised warfare.

DETERIORATION IN THE HEATING VALUE OF COAL DURING STORAGE.

HORACE C. PORTER.

In the issue of the *Journal of the Society of Chemical Industry* of February 28, 1919 (page 58R), Mr. G. Cecil Jones calls attention to Bulletin 136 of the Bureau of Mines, by the present writer and F. K. Ovitz, on the above-named subject, and suggests "that the authors have overlooked a form of loss which may be several times as great as the small loss they have measured with such care." He cites from the Bulletin and compiles averages of percentages of ash found in several lots of coal at successive stages in their storage, and points to the trend of these towards an increase during the storage of the coal. This trend, he says, "points almost irresistibly to the conclusion that there was a steady and far from insignificant loss of coal substance on storage." "The bulks were not weighed, and the deterioration measured was only that resulting from the fixation of oxygen, no account being taken of possible loss of coal substance in volatile form."

The possibility of change in weight of coal during exposure and weathering has been recognised by many of the investigators of coal deterioration, and the importance of the *rôle* that such change might assume in the net losses incurred has not been overlooked. In the very Bulletin quoted from there are reported (pages 24—25) certain tests on the Pittsburgh type of coal, throughout a period of five years, to determine this very matter, namely, the change in weight of the coal, calculated to the dry basis, and to show its bearing on the apparent loss in heating value. The results of two tests, each on 200lb. of coal over a period of five years, showed a change of plus 0.4 per cent. and plus 0.3 per cent. respectively in the dry weight of the test portions. This result conforms in general with the findings of other investigators, which show a slight increase in weight of the coal substance during exposure.

This result shows that with the Pittsburgh coal used in this experiment the change in weight was not sufficient to make it a material factor in the deterioration; in other words the determination, after storage, of the heating value *per pound* showed approximately the net loss of heat units in the total bulk of coal. The New River type of coal, which was used in the tests under discussion in the article quoted, is a coal of considerably less volatile matter than the Pittsburgh, and has certainly no greater tendency to undergo oxidation or other alteration during exposure.

If, in general, by weathering, coal may lose a part of its "substance in volatile form," or may oxidise at ordinary temperatures so as to have a part of its combustible substance carried away in oxides of carbon and water, there can be no question that any loss of weight so incurred must be added to the loss involved in the decrease of heating value per pound. This consideration has led to careful investigations of the nature of this change in the coal substance caused by exposure and by oxidation.

Richters*, Fayol†, Pennstedt‡, Bondouard§, Taffanel¶, Porter and Ralston||, and in England more recently Winmill** have studied the nature of the reaction of coal with oxygen at ordinary temperatures. They have shown that while a relatively small amount of oxides of carbon and of water is formed, the principal reaction is an addition of oxygen to the coal substance, and the net result is an increase in weight.

While there remains the possibility that water might be formed by oxidation of the hydrogen of the coal, and remain intimately bound in the coal substance so as to be removed only by heat in the course of analysis for moisture, this possibility is largely precluded by the fact that in the case in hand the coal analyses (see tables 4, 7, and 10, Bull. 136) do not show a material increase in moisture during dry storage.

The escape of volatile combustible matter from coal during exposure has been shown by Porter and Ovitz in a previous publication* to be inconsiderable in point of weight and calorific value. Of a number of coals investigated, including one similar to the New River type, the one showing the greatest loss of combustible gas during more than one year's exposure in air lost in this way only 0·16 per cent. of its calorific value and less than 0·1 per cent. by weight.

The experimental evidence above outlined shows that coal tends to increase slightly in weight during storage, and does not lose any appreciable amount of its combustible substance either by volatilisation or by oxidation. While in the experiments on New River coal, described in Bulletin 136 by Mr G. Cecil Jones, there was no actual measurement of change in weight, the burden of experimental evidence in similar tests and in the studies of the process of coal alteration just cited, is against the assignment of any important part in the deterioration to such a change.

It is impracticable to draw any definite meaning from the variation in content of ash apparently found in these tests in the successive samples of coal. The variations in ash were so irregular that averages are nearly worthless. Furthermore, if it were justifiable to draw a conclusion from such apparent increase of ash, there is found nearly as marked an indication of increase in the samples submerged in water (tables 3, 6 and 9), where no oxidation or volatilisation is likely to have occurred, as in those weathered by exposure. These irregularities are to be ascribed rather to the personal equation in sampling, to the accidental inclusion of foreign inorganic material in the test coal during repeated re-handlings and exposure, and to the possibility that the lighter and purer parts of the test lots of coal may have been washed or blown away during the long period of exposure to the elements.

Since deterioration can properly be determined only on the basis of ash-free, dry coal substance, and has been so determined in these tests, the irregularities in ash content of the successive samples are not of serious moment as affecting the accuracy of the results on deterioration. They certainly cannot, in themselves, without further corroborative evidence, be applied as an indication of proportionate change in weight of the material under test.

* Dingler's Polytech. Jour. 195 (1870). 375-331 and 449-458.
† Bull. Soc. Ind. Min. 8, ser. 2 (1879), 487.
‡ Zeit. angew. Chem. 21 (1908), 1060, 1825.
§ Bull. Soc. Chim. France, Ser. 4, Vol. 5 (1909), 377,380.
¶ Orig. Communications, 8th Internat. Cong. Appl. Chem. 1912), 10,277.
|| Tech. Pap. 65, Bureau of Mines (1914), 21-24.
** Iron and Coal Trades Rev. 87 (1913), 485, 92 (1916), 660.

* Tech. Pap. 2, Bureau of Mines, 1911.

Referring to the subject of the world's fuel resources in his presidential address to the British Association at Bournemouth, Sir Charles Parsons said that it had been estimated that the United Kingdom possesses 2½ per cent. of the total coal but less than 1 per cent. of the total water power in the world. To investigate the possibility of tapping the earth's internal heat energy, a shaft might be sunk 12 miles down in 85 years at a cost of £5,000,000.

THE JAPANESE DYESTUFF INDUSTRY.

Until the war cut off imports from abroad there were no colour-producing factories in Japan with the exception of certain works making pigments; the total of imports therefore represented exactly the total Japanese demand. The imports of dyestuffs were as follow:—

		1913.	1912.	1911.	1910.
Natural indigo		20,738 kin.	45,225 kin.	15,015 kin.	78,431 kin.
		Y.34,707	81,473	30,008	153,490
Synthetic indigo		1,652,977 kin	897,688 kin.	1,769,962 kin.	1,523,121 kin.
		Y.3,277,205	1,879,739	3,724,313	3,238,460
Aniline dyestuffs		7,362,460 kin.	7,291,840 kin.	8,023,420 kin.	6,576,076 kin.
		Y.4,213,149	3,027,067	3,478,551	2,885,136
Alizarine dyestuffs		159,496 kin.	149,347 kin.	190,684 kin.	140,876 kin.
		Y.267,963	219,850	255,310	216,850
Aniline salt		490,432 kin.	519,055 kin.	179,299 kin.	186,585 kin.
		Y.143,761	143,142	50,246	56,382
Logwood extract		722,718 kin.	585,777 kin.	684,947 kin.	683,279 kin.
		Y.135,410	105,999	116,958	118,110
Total		10,408,821 kin.	9,488,932 kin.	10,863,327 kin.	9,001,783 kin
		Y. 8,072,195	6,357,270	7,655,386	6,668,428

The entiro withdrawal of these imports naturally caused a great disturbance of the dyestuff market and an extraordinary rise in prices. As a consequence several colour-making plants were erected, the largest being that of the Nippon Senryo Seizo Kabushiki Kwaisha (Japan Dyestuff Manufacturing Co.), a firm which has received Government assistance. Several of the other firms, owing to shortage of capital and the lack of expert chemists, have been obliged to close their works.

The Yura Dyestuff Manufacturing Co. and the Mitsui Mining Co. are among the more successful companies. The Japan Colour Co. has also produced good Sulphur Blacks, which are now chiefly exported to China. Aniline oil and salt, the most easily made intermediates, were produced by every colour-making firm, and this soon brought about an over-production for the home market. The pre-war price of aniline salt was Y. 0·30; this rose soon after the outbreak of war to Y. 1·20, and has now fallen to Y. 0·60.

Among dyestuffs the sulphur colours at first attracted much attention, probably because of the comparative simplicity of their manufacture. Some makers utilised organic waste of all kinds for the raw material, going back in this respect to the original method of making "Cachou de Laval," the first of the Sulphur dyestuffs. Only a few makers have employed aromatic compounds as the starting point; these have naturally been the most successful, and are still making Sulphur Yellows, Browns, and Blacks, though they do not appear to give much attention to the purification of their commerical products.

The Nippon Senryo Seizo K.K. (Capital, 1,000,000 yen) and the Jura Senryo Seizo K.K. (Capital, 1,000,000 yen) have erected complete plants, and have succeeded in producing a range of marketable products. The Mitsui Mining Co. is making various anthracene colours and synthetic indigo. The most important dyestuffs manufactured in Japan at present are given in the following list:—

1. *Direct Cotton Colours:* Congo Red, Chrysamine G, Direct Orange, Cotton Blue R, BR, Heliotrope, Cotton Violet, Cotton Brown 2BR, Benzopurpurine 4B, Chrysophenine, Benzo Orange, Direct Yellow, Cotton Red, Diamine Scarlet.

2. *Basic Colours:* Rhodamine B, extra conc., Malachite Green, Methylene Blue, Methyl Violet, Magenta, Chrysoidine, Bismark Brown, Basic Rose, Cerise.

3. *Acid Colours:* Fast Pink B, Fast Red A.B, Fast Scarlet, Orange II, Naphthol Yellow S, Induline, Nigrosine, Acid Brown R, 3R, Metanil Yellow, Acid Yellow, Ponceau R, Azo-flavine, Citronine, Naphtylamine Brown, Golden Yellow, Brilliant Acid Blue, Acid Violet, Acid Green, Acid Red, Acid Blue B.BR, Fast Blue, Quinoline Yellow, Acid Brown AR.

4. *Mordant Colours:* Alizarines (Mitsui Mining Co.), Alizarine Blue, Alizarine Orange, Alizarine Maroon (Mitsui), Alizarine Brown (Nissen Co.), Anthracene Brown, Mordant Yellow, Chrome Brown, Chrome Yellow, Fast Chrome Violet, Steam Cosmos G (Ikeda Dye Co.).

5. *For Oxidised Colours:* Aniline Oil, Aniline Salt, Paramine, Fuscamine.

6. *For Insoluble Azo Colour:* Paranitraniline.

7. *Sulphur Colours:* A full range of blacks, browns, and yellows. Among them Kompira sulphur colours are the best known. The output of these dyes is not very certain; the following figures only are published:—

Sulphur colours	1,242,885 lb.	(March, 1919).
Aniline colours	549,290 ,,	,,
Paramine	8,400 ,,	(1918)
Paranitraniline	3,600 ,,	,,
Aniline oil	860,000 ,,	,,
Aniline salt	459,000 ,,	,,

Throughout Japan there were formerly 200 dyeworks with a total capital of 17,000,000 yen and employing about 20,000 persons. Since the armistice, however, both dye works and dyestuff merchants have been badly hit by the slump in dyestuffs, raw materials, and chemicals. The Sulphur dyestuffs were most seriously affected on account of accumulation of cargoes and depreciation in the value of the stocks of carbolic acid which were held as raw material for Sulphur Blacks. Attempts have been made to relieve the industry by increasing the tariff on imports and by strengthening the manufacturers' position through combination and amalgamation. A bill for the protection of the home dyestuff industry was introduced by Seiyukai in the House of Representatives, the main feature being an increase of import duty on foreign dyestuffs (with the exception of artificial indigo) to 50 per cent. *ad valorem* for the next five years. A decision is expected in the near future.

The production of coal-tar in Japan is insufficient to provide raw material for all the dyestuffs required by the country. Three of the most important gas works have published figures of their annual output of coal tar and distillation products as follows:—

	Coal tar output. Koku.	Coal tar distilled. Koku.	Naphthalene produced. Tons.	Benzol. Tons.	Pitch. Tons.
Tokyo Gas Works ..	72,845	95,454	309·86	202	9,391
Osaka Gas Works ..	14,027	25,855	329·77	—	3,168
Nagoya Gas Works ..	12,466	11,084	23·95	53	1,106

In 1917 the total amount was reported as—Coal tar 341,000 koku, naphthelene 943 tons, crude-benzol 410 tons, pitch 20,556 tons. (Koku = approx. 3 cwts.)

No later information is to hand, but it is known that many gas works have been shut down in the last few years. We may conclude that Japan is certainly short of the raw materials and intermediates required for dyestuff manufacture. The necessary chemicals have also been lacking, but their manufacture has recently commenced, and some of the home products are already on the market.

The Government Iron Works and the Manchurian Railway Co.'s Iron Works are also extending their coke plants, and will produce coal tar. Within a few years Japan will be able to supply her own requirements in dyestuffs, with the exception of special products such as vat colours and certain complex direct cotton colours.

At the moment the dyestuff market is stronger on the improving demand from the home weaving industry and the growing trade with China. (Yen = 2s. 0½d., kin = 1·33lb., koku = 3·97galls.)

MEETINGS OF OTHER SOCIETIES.

INSTITUTION OF MINING ENGINEERS.

The thirtieth annual general meeting was held at the University of Birmingham on September 10, when Mr. G. B. Walker presided over a gathering of some 200 members. The Institution was welcomed to the University by the Vice-principal, Sir William Ashley, who stated that during the war the University buildings had been used as a military hospital, and that the Mining Department had been suspended, but it was hoped to re-start it within a few weeks. The application of electricity might mark the beginning of a new epoch, as did the application of steam many years ago, so that the whole problem of mining education required to be considered afresh.

After the annual report had been adopted Colonel Blackett was elected the new president and took the chair.

Prof. Sir John Cadman then read the first report of the committee on "The Control of Atmospheric Conditions in Hot and Deep Mines." The conclusions were summarised thus:—(1) The hindering effects on men of the heat in deep mines depended not on the temperature of the air, but on the wet-bulb temperature and the degree of stagnation of the air. (2) In the downcast shaft and main intakes of a well-ventilated coal mine the natural temperature of the strata had no appreciable influence either on the temperature of the air or on the wet-bulb temperature. (3) The data as yet available indicated that by properly designed ventilation and avoidance of leakage the hindering effects of the heat in deep mines could be obviated up to any depths at present contemplated in the working of coal or other minerals in this country. During the discussion which followed Mr. Davies, a South African mining engineer, described the conditions in a hot and deep mine, where to make work possible the air was put through a refrigerator until a wet-bulb temperature of 43° F. was obtained.

Mr. D. S. Newey read a paper on a new method of working thick seams of coal at the Baggeridge Colliery. The system had been successful, the men being able to stand upright to their work and efficient ventilation being easily maintained.

The next contribution was by Mr. C. F. F. Eagar on the training of officers and men of the tunnelling companies of the Royal Engineers in mine rescue work on active service in France, which described in outline the scheme in operation on the Western Front for training officers and men in the use of portable breathing apparatus, artificial respiration, and the general work of mine rescue. The deadly nature of the gases given off by the use of large quantities of explosives was early realised, and under the supervision of Lt.-Col. D. Dale Logan a number of sets of Proto apparatus was sent out to France. Three types of apparatus were used—"Proto" and "Salvus," worn by the rescuers, and the "Novita" oxygen apparatus for use in connexion with artificial respiration. The method adopted in testing for carbon monoxide was to use a bird or a mouse, and to observe the rapidity with which the animal was affected. When these are confined in a cage the bird is undoubtedly the better gas-detector. The best method of using mice is to have them thoroughly tamed and accustomed to handling. They can then be carried in a button-up pocket or a little pouch and pulled out in the air to be tested. If a mouse is made to exercise by making it crawl from hand to hand it inhales much more of the tainted air, and it will usually collapse more rapidly than a bird sitting on a perch. All ranks were taught this method of testing, one of the real advantages of which was that it obviated the nuisance of having to carry a cage. Mr. Eagar also stated that palladium chloride had been tried as a test for carbon monoxide, but it was found to be almost too sensitive, and other gases also gave a darkening of the ring with palladium chloride, notably sulphuretted hydrogen. In the apparatus for absorbing carbon dioxide coke absorbent had been used, but there was a tendency for a crust of carbonate to form on the outside, leaving the caustic alkali inside unacted upon.

The annual dinner was held in the evening at the Grand Hotel, and the two following days were given up to excursions in the district.

THE IRON AND STEEL INSTITUTE.

The autumn meeting of the Iron and Steel Institute was held, on September 18 and 19, in the rooms of the Institution of Civil Engineers.

The first day was given up to contributions on the subject of fuel conservation based upon reports presented by the British Association Fuel Economy Committee, and by Messrs. Cosmo Johns and L. Ennis on fuel economy in the German iron and steel industry. (See this issue, p. 355 R.)

On the second day, Mr. C. A. Keller described a new process for the manufacture of "synthetic cast iron," which consists in the recarburisation of iron and steel scrap, and is designed to give an iron the composition of which can be readily controlled. An electric furnace is used, into which are charged the scrap and sufficient carbon to give the required composition. By the addition of an adequate quantity of a sufficiently basic slag the sulphur content can also be regulated. The method is specially applicable to the manufacture of low silicon cast iron for the purpose of making malleable castings; it has been found useful during the war in dealing with the large quantities of steel turnings produced in the manufacture of shells.

A number of papers was presented dealing with different aspects of the manufacture and applications of nickel chrome steel. In particular a paper by Messrs. J. H. Andrew, J. N. Greenwood, and G. W. Green described the complete treatment of forgings in this material during the whole course of manufacture, as carried out at the works of Sir W. G. Armstrong, Whitworth and Co., Ltd. Among other things the authors recommend the use of a low casting temperature, though a high ladle temperature is considered to be advantageous. Their paper is the most complete work of reference on the subject which has yet been published.

Papers by Messrs. R. H. Greaves, Miss M. Fell, and Sir R. Hadfield dealt with the phenomenon of "Krupp Krankheit," or temper brittleness, especially in nickel chrome steels, and reviewed the conditions under which this form of brittleness is met with in certain steels, while Dr. Rogers described methods by which he is studying the same problem. The discussion on these papers was well sustained, and a number of interesting facts concerning the phenomenon were disclosed, especially by Mr. Dickenson, whose work on this subject, which was circulated as a secret document in 1917, has not previously been published. The methods which must be adopted to avoid temper brittleness appear to be well known, but the discussion indicated very clearly that the causes of this weakness in nickel chrome or other steels are quite unknown.

Papers by Messieurs Cohade and Portevin dealt with the "woody" fracture of nickel chrome steels. This type of fracture is generally associated with the presence of non-metallic enclosures in the steel, and is noticed when the metal is broken in a direction transverse to the direction of working. M. Cohade suggests that, while other factors are undoubtedly important, chemical composition of the steel has an effect which has not yet been realised. In the ensuing discussion a number of

other theories were advanced. There seemed to be a consensus of opinion among practical steel manufacturers that this form of fracture could best be avoided by the use of a high casting temperature.

Messrs. J. H. Whitley and A. F. Hallimond discussed the action of iron oxides on the structure of the acid open hearth furnace. The sources of the oxides were considered, and also their action on different portions of the furnace structure. Microstructures of various materials after service in the furnace were shown, and methods suggested by which the deleterious effects may be avoided.

Finally, a paper by Messrs. K. Honda and H. Takagi on the irreversibility of the nickel steels was discussed. Dr. Benedicks drew attention to the theory of Osmond and to his own work on the subject, and suggested that the irreversibility had already been explained without the necessity for the complicated theory of the authors.

A number of other papers, for which time could not be found at the meeting, are to be discussed by correspondence.

CHEMICAL INDUSTRY CLUB.

A meeting of the members of this club was held at Whitehall Court on September 22. There was a good attendance, and Mr. Richard B. Pilcher occupied the chair. The meeting was convened in order to discuss various matters relating to the forthcoming Annual Dinner and Annual General Meeting and to the improvement of the club generally. The Honorary Secretary reported that the membership now numbered 650.

CORRESPONDENCE.

CHEMICAL COMPENDIA AND ABSTRACTS.

Sir,—The question of the publication of chemical compendia and chemical abstracts has been discussed in your columns from various sides. I should like to consider it mainly from the scientific point of view, but do so with diffidence, as there is little I can say on the matter which will not be obvious and therefore commonplace.

The utility and the indispensability of compendia and abstracts have been admitted by all. Differences of opinion exist, however, with regard to the form the publications should take. Sir William Pope has suggested that there should be three types—reprints in English of the more important of the older chemical papers, a complete series of abstracts, and compendia, similar to Beilstein's Handbook of Organic Chemistry, covering the chief divisions of pure and applied chemistry.

Reprints of the more important of the older papers would undoubtedly form a useful publication, but it would not relieve the research chemist from the necessity of keeping complete sets of the better known journals at hand in his library. As Prof. J. B. Cohen has pointed out, an organic chemist refers to the little known papers of some Hans Schmidt much more frequently than he does to the classical memoirs of a Justus von Liebig. The reprinting of these papers would probably prove of less advantage to a research worker than it would to an advanced student. In connexion with the latter, I may perhaps be pardoned if I here express the opinion that we do not provide sufficiently for the wants of the advanced student of *systematic* organic chemistry. The translations, such as that of Richter's Organic Chemistry, which are in his hands to-day, are as dry as dust in comparison with the organic portion of the treatise which was written about thirty years ago by Roscoe and Schorlemmer. It seems a pity that this work, which is more readable and more interesting than any treatise on systematic organic chemistry hitherto published in any language, is not kept up to date.

Of the remaining two types of publications, compendia and abstracts, the latter are the more important. It is much to be regretted that most of the chemical societies deem it necessary to publish abstracts and to insist on their members subscribing for these abstracts as well as for their transactions. One would have thought that the course adopted by the German Chemical Society, twenty-two years ago, would have commended itself to other societies in the interval. A chemist who may feel it necessary to subscribe for the transactions of each of the larger chemical societies would be obliged to acquire at the same time duplicate, triplicate or, in general, multiplicate abstracts of little, if any, use to him in his work. I am quite in agreement, therefore, with Sir William Pope in recommending, if I understand him aright, that England, America, France and Italy should cease from issuing national abstracts and should combine for the publication in the English and French languages of one series of abstracts dealing, so far as possible, with every published paper and patent in pure and applied chemistry. If this were done any chemist could, if he so desired, have one complete series of abstracts and the original papers of three or four of the leading chemical societies at a price less than one-half of what he must now pay for them.

Provided we had a good series of abstracts covering pure and applied chemistry the writing of compendia would be a relatively simple, although a somewhat laborious, matter. Beilstein's Handbook of Organic Chemistry has been of such great use to chemists in the past that it is quite unnecessary to discuss the desirability of compiling similar handbooks dealing with other branches of chemistry. It is possible that owing to the financial condition of Germany, resulting from the late war, other editions of Beilstein's Handbook will not reach the high standard of the present issue, and that the chemical world will, in the future, look to England and America for a compendium to take its place. As Sir William Pope has suggested, it would be of great advantage to have similar compendia of technical, physical and inorganic chemistry. Thorpe's Dictionary could serve as a basis for a technical, and Moissan's for an inorganic, handbook, unless it should be considered advisable to regard physical and inorganic chemistry as a single subject—general chemistry—when a handbook such as Abegg's would rather commend itself.

Biennial registers of literature, such as Stelzner's, would be of little use to a research chemist who had a good quinquennial index of first-class abstracts at his disposal. A lexicon of the Richter type is more useful, but its advantages are rather over-estimated. An organic chemist, in active research work, who has an up-to-date Beilstein in his laboratory can readily dispense with the lexicon.—I am, Sir, etc., Hugh Ryan.

Dublin, Sept. 8, 1919.

Research Associations for the Glass and Refractories Industries.—The Glass Research Association, established in accordance with the Government's scheme for encouraging industrial research, has been licensed by the Board of Trade as a company not trading for profit. The secretary is Mr. E. Meigh, 7, Seamore Place, W. 1.

The Department of Scientific and Industrial Research has approved the Memorandum and Articles of the British Refractories Research Association, which are now under consideration by the Board of Trade. Mr. A. C. Rann, 14, Great George Street, Westminster, S.W.1, will act as secretary of the Association.

NEWS AND NOTES.

AUSTRALIA.

Exploitation of Victoria Brown Coal.—The Victorian Government contemplates the development of the brown coal deposits occurring at Morwell, about 80 miles east of Melbourne. The first cost is estimated at about £1,855,000. The available coal amounts to at least 20 thousand million tons. It is proposed to erect at Morwell an electric generating station with an initial capacity of 50,000 KW, to be increased to 100,000 KW by 1925. The estimated cost of current delivered therefrom to Melbourne is 0·326d. per unit. The production of briquettes on the low temperature carbonisation system is an essential part of the scheme. The output of the briquetting plant will probably be 200 tons per day initially.—(*Bd. of Trade J., Sept.* 4, 1919.)

Tungsten Minerals.—The attention of the Australian House of Representatives was recently directed to Governmental lack of enterprise as regards Australia's resources in wolfram, scheelite and molybdenite. Prior to the war Australia's whole output of these minerals was exported to Magdeburg, in Germany, but now the control of the minerals is vested in the Commonwealth Government. The contract with the British Government for the sale of molybdenite at 100s. per unit and of wolfram at 52s. per unit will probably continue until the end of the current year. The whole of the mines and works in the north of New South Wales, and the works in Sydney, are closed down consequent upon notification received from the authorised buyers that tungsten ores would not be accepted unless of a certain standard. To this standard the various works are unable to conform. The world's consumption of tungsten ores advanced from 4000 tons in 1906 to 10,000 tons in 1913. The United States output of tungsten ores was increased to 7000 tons in 1916, while the Empire production in 1916 was under 6000 tons. The British Government secured supplies of tungsten from Australia during the war at £400—£500 per ton, compared with £2000 per ton paid for the Norwegian and Swedish products. The Bureau of Science and Industry should carry out large-scale researches in the production of tungsten steels. The industry should be protected and the sales markets opened up so that the best price might be realised for the product. — (*Industrial Australian and Mining Standard, July* 31, 1919.)

Gold Discovery in Western Australia. The Premier of Western Australia has announced that a large ore formation was discovered in June last on land held by Hampton Properties, Ltd., situated twenty-three miles south of Kalgoorlie. Shaft sinking has disclosed a lode formation 25ft. wide, with the ore channel traceable north and south for a considerable distance. The country rock is oxidised to a depth of 60ft., and is comprised of ferruginous quartz and soft lode formation giving high assay values. The discovery is considered to be of very great promise. There is also another ore formation about half a mile eastward showing visible gold.—(*Official, Sept.* 20, 1919.)

UNITED STATES.

Coal Tar Industry.—In 1918 one hundred and eighty firms were actively engaged in the production of coal tar derivatives in the United States, employing 26,217 employees of all grades. Of this number 2233 were technically trained men.

Tanning Industry.—The tanners in the United States have, though their council, under serious consideration the question of establisbing a school to teach the tanning industry in a thorough manner. Whether a separate school shall be created or a separate college established at one of the universities has not been decided.

Petroleum Industry.—Since the petroleum industry is one of the most prominent of the chemical industries, it is interesting to note that the greatest unit of the Standard Oil group is equipped to handle about 200,000 barrels of crude oil daily, and it also operates nearly fifty large tank steamers. In its main engineering and research laboratory a staff of about ninety is employed on many phases of the petroleum problem, including the standardisation of tests and the perfection of testing apparatus.

The Alcohol Problem.—Gradually the breweries are finding new uses, the last to report having become a modern macaroni factory. Meanwhile a fight is being waged to secure regulations permitting alcohol used in the industries to be made tax free. Alcohol is quite important, if indeed not essential, in the production or refining of some 150 materials in industrial chemistry and pharmacy, to say nothing of its use in producing light, heat and power. Several recent experiments with alcohol as a motor fuel even in aeroplanes have yielded results encouraging to those interested in its use.

Coke Industry.—A by-product coke plant in Pennsylvania is operating 768 ovens divided into 12 batteries and consuming 12,500 net tons of coal every 24 hours. The plan contemplates eventually 24 batteries of 64 ovens each. From 12,500 tons of coal the products are approximately as follows:—8000 tons of screened furnace coke containing 2½ per cent. moisture, 520 tons of small domestic coke, 900 tons coke dust, 150,000 gallons of coal tar, 162 tons sulphate of ammonia, 29,000 galls. pure benzine, 7400 galls. pure toluene ,2800 galls. crude light solvents, 1400 galls. crude heavy solvents, and 75,000,000 cubic feet of gas in excess of requirements for the plant itself. This gas is of 575 B.T.U. The plant is said to represent the very acme of by-product oven installation and efficient operation.

SOUTH AFRICA.

Natal Sugar Industry.—H.M. Senior Trade Commissioner reports the receipt of the following statistics of the Natal sugar industry (crop 1917-18) from a reliable local source:—

- Area under cultivation: Between 130,000 and 140,000 acres.
- Area from which cane was cut last season: Say 60,000 acres.
- Total output of cane: Say 1,320,000 tons.
- Output of cane per acre: Average 20—24 tons.
- Total output of sugar: 108,000 tons.
- Output of sugar per acre: Say 1¾ tons.
- Average weight of sugar per ton of cane: Say 1·8 cwt.
- Price realised per ton of sugar: £25 average.
- Value of season's output: £2,700,000.
- Number of factories: 27.
- Total capacity of factories: Say 150,000 tons per season.
- Number of refineries: Two.
- Output of refineries: 60,000 tons in each case.
- Deficiency of production: 17,000 tons.
- Sugar consumption, South Africa: 125,000 tons.

The 1917-18 crop was a short one, due to drought and floods.—(*Bd. of Trade J., Sept.* 4, 1919.)

GENERAL.

Derbyshire Oil.—It is stated on the authority of Sir John Cadman, Chairman of the Petroleum Executive of the Ministry of Munitions, that the daily yield of oil from the Hardstoft boring has averaged a ton a day for the past two or three months. No oil has been struck in the six other bore holes put down in Derbyshire.

The Anti-Scorbutic Factor in Human Dietary.—The report of the Lister Institute of Preventive Medicine for 1919 shows that much valuable work has been done in the Department of Experimental Pathology on the anti-scurvy accessory factor in some common foodstuffs. In a research on the best method of preserving lemon juice so as to retain its anti-scorbutic virtue, it was discovered that the juice of the West Indian lime both when fresh and preserved is greatly inferior to that of the lemon. Historical search has shown that at the time scurvy was successfully combated in the British navy and mercantile marine, the "lime juice" distributed to the sailors was made of lemons. Swede juice was found to be the most effective substitute for the juices of oranges and lemons, and the other root vegetables investigated in order of potency are, the potato, carrot, and beetroot; these are greatly inferior to swedes, and the juice of the last-named was found to be a quite ineffective preventive of scurvy even in very large doses. Investigations of milk showed conclusively that dried milk, even when freshly prepared, is much inferior in anti-scorbutic value to raw milk or "scalded" milk; the difference in growth-promoting properties is, however, much less marked. Research also showed that vegetables, such as cabbages and French beans, lose practically all their original anti-scorbutic value in the process of canning; as their food value is also low it follows that canned vegetables are not an economic element of diet. This does not apply to the canning of fruits. Dried vegetables were also found to be deficient in anti-scorbutic properties, the degree of loss depending chiefly upon the disorganisation of the tissues during drying, but to a small extent upon the time of storage. In addition to the above work, an investigation into the effect of prolonged cold storage upon the accessory food factors contained in some natural products is being carried on at the request of the Food Investigation Board of the Department for Scientific and Industrial Research.

An important feature of this nutritional research has been the introduction of the quantitative factor, the neglect of which in the past has led to conclusions which may be quite erroneous. For example: in studying the changes in anti-scorbutic content during cooking, it is evident that if the foodstuff in the amount given contains, when raw, a large excess over the minimum required, any loss sustained will not be assessed or even detected if the residual amount in the cooked ration is still in excess of that minimum. In estimating the relative anti-scorbutic value of any given series of foodstuffs, the first step necessary is to determine experimentally for each substance the minimum daily ration which will protect the experimental animal from scurvy under the conditions of the experiment. An accurate estimate of the loss sustained by heating, drying or other methods of preservation can then be obtained by a comparison between the minimum rations required before, and after, the operation in question. The determination of these minima involves a large number of experiments, but these are necessary if the results obtained are to be other than misleading.

Production Costs of Chilean Nitrate.—The cost of Chilean nitrate on board ship comprises (*a*) cost of mining and transporting the *caliche* from the deposit to the extraction plant (oficina), (*b*) manufacturing costs, (*c*) cost of transporting to the ship, (*d*) administration expenses.

(*a*) This cost varies from 3s. 3d. to 6s. 10d. per short ton, of which labour accounts for 70 per cent. It might be reduced by improved mining methods, by part substitution of mechanical for hand labour, and of trucks for mule waggons. (*b*) The cost of extraction is now 3s. 9d. to 5s. 8d. per short ton, of which labour accounts for 30 per cent., fuel 60 per cent., and technical control less than 1 per cent. There is great scope for technical control, particularly in regard to fuel consumption. By the present method of heating over 65 per cent. of the fuel is not utilised; and methods of extraction could be improved so as to yield 75 per cent. even with low-grade caliche. (*c*) Transportation from the oficinas to the ship costs about £3 15s. per short ton of commercial nitrate, 65 per cent. of which goes to the Chilean Government as export tax (2s. 4d. per quintal of 101·6 lb.). (*d*) Administration costs amount to approximately 1s. 7d. to 2s. 6d. per short ton of caliche. The above items of costs work out to about £4 6s. 8d. per short, or £4 16s. per long ton.—(*J. Ind. Eng. Chem., Aug.*, 1919.)

Synthetic Nitrogen Compounds in Germany.—Lieut. R. E. McConnell has recently inspected the Haber plant at the Oppau works of the Badische Soda u. Anilin Fabrik near Ludwigshafen on the Rhine. As the Germans raised strong objections to detailed examination, he was only able to spend three days at the factory and was not permitted to view the plant in actual operation. During the year ended November 1, 1918, this plant produced 90,000 long tons of fixed nitrogen, *i.e.*, its capacity was equal to one-fifth of the total three million tons of nitrate supplied by Chile to the entire world during the same period, and ten times that of the Haber plant installed by the U.S. Government at Sheffield, Alabama. If to this output be added the reported production of 125,000 tons at a factory near Halle, the combined output would be equal to one-half that of the total supply from Chile. It has been officially stated in the Reichstag that 400,000 tons of combined nitrogen was produced in Germany in 1916. However this may be, it seems certain that Germany is capable of exporting nitrogenous compounds in amounts approximately equal to her pre-war normal consumption of 750,000 tons of Chilean nitrate. The producing capacity of the Oppau works at the present time is estimated to be:—

Oppau Plant.	Tons per annum	Tons combined nitrogen per annum.
Ammonium nitrate	10,000 ..	3,450
Sodium nitrate	130,000 ..	21,410
Nitric acid (100%)	40,000 ..	8,890
Ammonia (liquid)	40,000 ..	32,900
	Total	.. 66,700

The cost of the plant is stated to have been between 5 and 10 millions sterling; to-day a similar plant in the United States would cost at least £13,000,000. The personnel of the factory comprises 1500 labourers, 3000 mechanics, 350 clerks and 300 chemists. The daily consumption of fuel is 1750 tons of lignite and 500 tons of coke, and the total cost per diem is about £11,000, including allowances for depreciation, etc. Assuming that in normal times the plant would be shut down for repairs, etc., during one-tenth of the year, the total cost would be £11,600, and the output 553,000 lb. of combined nitrogen, *i.e.*, the production cost would be about 5½d. per lb., equivalent to Chilean nitrate at 0·87d. per lb. (The latest reported price of the latter is 9s. per quintal, say 1d. per lb., in Chile.) If all the ammonia produced were converted into 100% nitric acid, the author concludes that the plant could produce acid at a cost not exceeding 3 cents (1½d.) per lb. The pre-war cost in the United States of this acid made from Chilean nitrate was 5-6 cents per lb. (2½d.—3d.), and to-day it will be considerably higher. Finally, the author indicates the serious consequences which would result from Germany acquiring a monopoly of these nitrogen compounds.—(*J. Ind. Eng. Chem., Sept.*, 1919.)

The German Bromine Industry.—The report of the Bromine Selling Association for 1918 states that

the average price of bromine was somewhat better than in the previous year, but the cost of production was much higher. During the first three quarters of the year business was buoyant notwithstanding many difficulties, but it received a sudden check at the time of the armistice. The usual peace-time customers held back on account of lack of other materials and of the uncertain outlook, but more serious was, and is, the closing of former markets. The enemies of Germany are not likely to forsake their bromine industries which they have initiated or resuscitated during the war. The outlook for this industry is the worst imaginable.—(*Z. angew. Chem., July* 11, 1919.)

Iron and Manganese Ore Deposits in the Idarwald, Germany.—The British Military Governor reports that during the past few months prospecting for iron and manganese has been taking place in the Idarwald, about 50 kilom. south of Coblentz. The existence of these deposits was known before the war, but with the Lorraine ironfields in their possession, the Germans did not consider their exploitation sufficiently profitable. The work of the last few months, however, has given very satisfactory results, and it appears that the whole of the Idarwald is rich in these minerals. Deposits have already been discovered in the regions of Rhaunen-Sulzbach, Weitersbach, and Hornbruch (about 20 kilom. W. by S. of Berncastel). The ore is found at a depth of from 6 to 10 ft., but in several places also just below the surface. Analysis shows that it contains from 55 to 60 per cent. iron, and up to 30 per cent. manganese. Its transport could be effected at a small cost by means of the Hunsrück railway.—(*Bd. of Trade J., Sept.* 11, 1919.)

The German Sulphuric Acid Industry.—Before the war copper pyrites and zinc blende were by far the most important sources of sulphur for the manufacture of sulphuric acid. In 1912, 262,700 metric tons of copper pyrites was produced in Germany and 1,073,235 tons was imported, 84 per cent. of which came from Spain and the remainder from Portugal, Turkey, Norway and France. In the same year 982,000 tons of copper pyrites (109,000 from Germany), 550,000 tons of zinc blende (410,000 from Germany), 44,500 tons of sulphur-containing copper and lead ores, and 35,500 tons of material from the purification of coal gas were used in the production of 1,650,000 tons of 100 per cent. sulphuric acid and 470,000 tons of zinc oxide were obtained, among other products, from the above amount of sulphuric acid. In 1890 the production of sulphuric acid in Germany was 1,150,000 tons. At the present time Germany, having had to fall back upon her unlimited deposits of kieserite and gypsum as sources of sulphur, is, like America, independent of foreign countries as regards the production of sulphuric acid. Hardly any free sulphur is now used in making vitriol or black gunpowder, but an increasing quantity is employed in the treatment of vines, wine casks, and hops, for the manufacture of ultramarine, and for vulcanising rubber. In 1913 Germany imported 46,636 tons of sulphur, of which 85 per cent. came from Italy.—(*Z. angew. Chem., July* 11, 1919.)

Magnesite in Italy.—Owing to diminished importation of magnesite from Austria and Greece, deposits of magnesite have been worked near Leghorn and in Tuscany, and the bricks and cement produced there have met with considerable success. The mineral contains up to 95 per cent. of magnesium carbonate and is comparatively low in silica 2·06—3·50 per cent.) Whereas the imports fell from 1316 metric tons in 1913 to zero in 1918, the production of magnesite rose from 400 tons in 1912 to 24,000 tons in 1918, and it is considered that the Italian deposits are sufficient to satisfy the home requirements both for the manufacture of refractory materials and for that of pharmaceutical preparations. Plans are being made to raise the output to 50,000 tons a year, thus providing a surplus for export.—(*Weekly Bull. Dept. of Trade and Commerce, Canada, July* 14, 1919.)

Vanadium Extraction in Sweden.—The presence of vanadium in Taberg ore has been known for nearly 100 years, but, as was found by German undertakings before the war, the proportion of vanadium (about 0·2 to 0·3 per cent.) present is too low to permit of profitable extraction. English vanadium is again on the market at a much lower price, and even in Sweden there are better sources, *e.g.*, at Tuoellevaar, but the export from this source is prohibited. It is probable that the accumulated slags at Taberg are rich in vanadium, but their quantity is not great, and the report that a syndicate has been formed to work them lacks confirmation. The large quantity of easily accessible ore at Taberg, estimated at several million tons, is poor in iron (20 to 30 per cent.) and its high titanium content renders it difficult to smelt. These reasons led to the abandoning of work in the 'seventies, and now, owing to the high price of coal, profitable working is even less to be expected. Further, as the ore cannot be economically concentrated, there is little prospect that the slag will be worked for vanadium on any considerable scale.—(*Z. angew. Chem., July* 11, 1919.)

Dye Industry in Denmark.—Under the direction of two chemists of standing, experiments on the manufacture of dyes have been in progress for some time at a factory at Valby, near Copenhagen, the results of which, although kept strictly secret, are understood to be successful. Various intermediate products have already been made, and it is hoped by building up a Danish dye industry to render Denmark independent of foreign dyes.—(*Z. angew. Chem., July* 11, 1919.)

The Cork Industry in Sardinia.—Cork trees are indigenous to Sardinia, extensive natural forests occurring on the mountain slopes in the northern part of the island. The crop is cut every nine years—that is to say, a tree stripped of its bark this season will be left untouched until 1928.

The cork industry is in a flourishing condition, as large profits have been made during the war. A big factory at Tempio is now being enlarged to enable it to increase its output fourfold.

The process of making cork stoppers from cork bark, as employed in the Tempio factory, is comparatively simple. The dried bark in its cylindrical form is first thoroughly steamed and flattened out under pressure. It remains in piles for about thirty days and reappears covered with a blue mould. The bark is then carefully scraped on both sides and cut into strips corresponding in width to the varying length of the cork stoppers desired. These strips are cut by hand into cubes, a process which calls for highly skilled labour and an apprenticeship of at least four years.

The cork strips are full of defects, and it requires a skilled hand and eye to obtain from the cork the maximum amount of merchantable material. The cork cubes are put through high-speed finishing machines, which round off the edges and give the required taper. This cutting process involves a waste of 20 per cent., and is being superseded by an abrasive process which wastes less than 3 per cent. The fine cork dust, which is a by-product of the abrasive process, found a ready market in Germany before the war at from 40 to 45 marks per quintal (about £18 per ton). At Terranova cork is prepared in other forms for export. The best cork is baled in sheets for shipment. The inferior cork is ground to a coarse dust and employed with a magnesium surface finish for sound-proof walls and floor coverings. Two American firms absorb practically the entire output of this factory.

The war stimulated the cork industry principally through the demand for trench mattresses, which,

in addition to their light weight, furnish very good protection against cold and moisture. With the possible exception of olive oil, cork is probably the leading article of export produced on the island.—(*U.S. Com. Rep., July* 25, 1919.)

The Sugar Industry in Spain.—Spain is the only European country in which sugar cane is grown; its cultivation is limited mainly to the province of Andalusia, on account of its high temperature and the absence of frosts. The cane sugar industry dates back to the Moorish conquest. By the year 1150 it already produced 1200 tons of sugar a year, and quite double that amount in the 15th century. The cane is planted in double rows in March and ripens by March in the following year, yielding a crop of 18—20 tons per acre with 13—15 per cent. of sugar. During the dry season, which lasts for three to four months, irrigation is essential, also the application of artificial manures. The beet sugar industry is of comparatively recent date. In 1886 there were two factories, in 1889—1890 eleven. In 1903 there were 47 factories with a possible output (including 25,000 tons of cane sugar) of 175,000 tons, an amount which would exceed the annual consumption, which, on the basis of 16 lb. per head and a population of 20,000,000, works out at about 160,000 tons. In 1904 an amalgamation of factories took place to form a syndicate whose aim was to strengthen the position of the industry by monopolising the production of sugar and its sale and by reducing the number of factories. At the present time the outlook of the sugar industry in Spain is not promising. The Government is expected to come to its assistance. All European beet sugar industries are forced to impose duties on tropical cane sugar or they would be overwhelmed by it. This did not apply to Spain so long as she possessed colonies of her own, against whose interests it would been to establish a strong industry at home by means of protection. When she was deprived of her colonies in 1898 there was no longer any need for her to take that course; consequently an import duty was imposed in order to protect the home sugar industry, so that in normal times Spain was not an important buyer of foreign sugar. The declining sugar production and larger exports during the war greatly reduced Spain's reserves. Great Britain, for example, in 1914 took 9348 tons, and in 1915, 1409 tons. Before the war, 1913—14, the annual production of cane sugar was 13,000 tons; in 1917—18 it had dropped to 6000 tons. The total beet sugar produced in 1913—14 was 169,400 tons; in 1917—18 it had dropped to 115,000 tons. On January 30, 1916, therefore, the import duty was reduced from 60 to 25 pesetas per 100 kilo. (say from 23s. to 10s. per cwt.), notwithstanding the protests on the part of the growers. As a consequence the imports rose in 1916 to 18,000 tons, and in 1917 to 39,000 tons. The argument advanced by the Government was that in view of the prevailing transport difficulties the danger of large quantities of sugar entering the country was small. As soon as these transport difficulties ceased to exist the Spanish market was flooded with foreign sugar. Thus during two months in the earlier part of this year about 20,000 tons was imported from Java and the United States, with many further loads on the way. The price of sugar fell 16 points, and the manufacturers felt that unless given protection their industry was doomed. Now, however, the former import duty of about 23s. per cwt. is again being levied, having become effective from May 24 last.—(*El Economista, May*, 1919.)

The Egyptian Sugar Industry.—The Dutch Consular Attaché draws attention to the frequent reports in the Egyptian Press of the satisfactory development of the sugar industry in Egypt during the current year, in the first four months of which the factories have not only supplied the requirements of Egypt and the Sudan, but have exported 43,205 bags of sugar, as compared with 23,853 bags in the corresponding period of 1918. At the present time the sugar cane plantations are not supplying the refineries with sufficient material to keep them fully occupied, and some of the factories have suffered damage in the internal disturbances at Kom Ombo. (*Z. angew. Chem., July* 11, 1919.)

New Coal Deposits in Chile.—The first of several coal deposits recently found in the south of Chile is situated near La Union. It is estimated that forty million tons of very good quality coal can be obtained therefrom. Nine deposits have been found in the Department of Castro, where the coal is of the boghead or cannel type. A large output of coal is anticipated from the mines of Lemuy. A coal deposit has been found at Mailef, ten kilometres from Valdivia. It has been little worked hitherto.—(*Bd. of Trade J., Aug.* 28, 1919.)

The Mineral Wealth of Rio Grande (Brazil).—The British Consul reports that wolfram is by far the most important of the metallic minerals occurring in this State. It is found, along with tin ore, in Encruzilhada, and traces occur in Sao Jeronymo. Copper is found in Camaquam, Cachoeira, S. Sepe, Cacapava, Sao Gabriel and Bage and in smaller quantities in Dom Pedrito, Lavras and Quarahym. Iron deposits occur in all the municipalities, the more profitable being those of Sao Jeronymo, where red hematite is associated with limonite. Gold in small quantities occurs in a number of municipalities. Sulphide of lead is found in Lavras and Cacapava, along with sulphide of zinc. Traces of silver are present in the lead occurring in Encruzilhada. Marble and limestone are very abundant in certain zones, and granite and "porphyros" are being largely quarried. Kaolin is widely distributed, and there is abundance of mica. Graphite, molybdenum and monazite are also present. Efforts are being made to develop the deposits of petroleum, and a company is being formed to manufacture cement, the raw materials for which appear to be abundant.—(*Bd. of Trade J., Aug.* 28, 1919.)

The Sampling of Coal.—Bulletin No. 2 of The Lancashire and Cheshire Coal Research Association, by F. S. Sinnatt, is intended to assist in the evolution of a standard method of sampling coal, an operation which is too often left in the hands of men who do not appreciate the importance of detail. It is urged that as much care should be expended upon the sampling as upon the analysis. One of the chief sources of inaccuracy in heat balance sheets lies in the fact that the sample submitted for analysis does not truly represent the coal used in the trial. Several examples of inaccurate sampling are quoted, and stress is laid upon the necessity for having a correct proportion of the various sizes of all constituents of the bulk. The diversity of the bulk will determine the size of the sample, but in general the larger the sample the more representative it will be of the bulk. The correct relationship to be maintained between the weight of the original sample and the size of the largest piece of foreign matter has been stated by Bailey. (*See* this J., 1909, 357.) The author considers that the gross sample should be from 1-40 to 1-80 of the total weight of coal, so long as the sample does not exceed 1000 lb. Unless a mechanical sampler or a small crusher is available errors are introduced in handling samples larger than 1000 lb.

The ordinary shovelful of 12·25lb. is generally accepted as the smallest unit to be removed during the sampling of lump coal. For slack or washed coal up to nut size, the unit should be 5 lb. When dealing with large lumps a number should be broken, and the unit taken from the broken portion.

The Standard Coal Specification of the Associated Municipal Electrical Engineers of Greater London specifies the limiting percentage of small coal to be permitted in deliveries. (*See* this J., 1913, 410.) A sieving test upon an uncrushed sample of coal will indicate when variation in quality may be expected.

It is impossible to obtain a true sample from the surface of stationary masses of coal, the units of the sample should be taken from each barrow or small truck as the coal is being loaded or unloaded. When sampling a seam of coal a pillar about 6 × 6 in. should be taken through the whole depth of the seam and including a portion of the roof and floor. This should be packed in a suitable box, so that an exhaustive examination may be made.

Before coning and quartering a sample, it should be crushed to an extent depending upon its weight, as shown in the following table:—

Weight of sample to be quartered. Pounds.	Greatest size of pieces of coal and foreign matter. Inches.
3,800	1¼
1,200	1
460	¾
180	½
40	2 mesh.
5	4 "
½	8 "
¼	10 "

The same principle being followed in the laboratory, coal passing a 20-mesh screen should not be reduced to less than 3 grms.

The importance of preserving samples in air-tight vessels to prevent variations in moisture content is emphasized. It has been found that the moisture content of the crushed coal sample may increase or decrease with the humidity of the atmosphere to the extent of at least 0·5% during a period of 6 hours.

The samples for use in the laboratory should all be passed through a 20-mesh sieve, taking care that none of the more refractory constituents are rejected at this stage. When the coal is required in a finer state, as for determinations of sulphur and nitrogen, it is conveniently powdered to pass a 200-mesh in a porcelain ball mill. By this means there is little change due to atmospheric oxidation.

The efficiency of sampling is increased by the adoption of mechanical crushers and riffles. A lengthy extract from the Board of Trade leaflet on Coal Sampling is attached to the bulletin.

The Phosphate Industry in Tunis.—The following table gives the total production of the Tunisian mines and the value of the respective minerals in 1913:—

	Tons.	Francs.
Phosphates ...	2,072,000 ...	45,500,000
Lead ore	59,500 ...	9,500,000
Zinc ore	28,600 ...	3,000,000
Iron ore	594,200 ...	7,500,000

The quantities of mineral ores and phosphates transported by Tunisian railways during 1918, and their respective values, were as follows:—

	Tons.	Value in Francs.
Phosphates ...	862,494 ...	25,874,820
Lead ore	30,662 ...	13,031,350
Lead, pure ...	301 ...	361,200
Zinc ore	5,508 ...	1,046,520
Iron ore	445,022 ...	12,238,105
Manganese ore ...	830 ...	49,800
Lignites	41,555 ...	2,493,300

Tunisian phosphates are classed under two categories according as they contain 58—63 per cent. or 63—68 per cent. of tricalcium phosphate with less than 2 per cent. of combined iron and alumina. The activity of the phosphate mines was greatly restricted during the war, and concomitantly the price of superphosphate advanced from 5—6 frs. to 30 frs. per 100 kilos. The exports of phosphates from Tunis to various countries in 1913, 1917 and 1918 were as follows:—

	1913	1917	1918 (1st ½-yr.)
	Tons.	Tons.	Tons.
United Kingdom ...	181,305	204,645	219,343
France	698,529	142,281	80,767
Italy	453,183	225,908	72,344
Portugal	40,404	12,730	——
Spain	52,985	16,315	4,960
Denmark	12,437	10,562	——
Other countries ...	546,037	——	290
Total	1,984,880	612,441	377,704

Exports to neutral countries amounted to 189,000 tons in 1916, 27,000 tons in 1917, and 5,250 tons during the first half-year of 1918. Before the war the United Kingdom imported great quantities of phosphates from Florida, and it is anticipated that the British market will now be more open to African phosphates than was the case before 1913. —(*Bd. of Trade J.*, *Aug.* 28, 1919.)

Motor Fuel.—The comparative merits of various forms of propellents for motor vehicles have formed the subject of some recent articles in the Parisian journal *La Vie du Grand Air*. The objections to the substitution of benzol for petrol as fuel are that its density, 0·840, is high, thus necessitating a heavier make of carburetter. Its inflammability is also high, *viz.*, +15° C., in comparison with −17° C. for petrol, and thus naturally makes the starting of the engine more difficult than with the standard fuel; and, again, the freezing point at −7° C. is much higher than that of petrol (−100° C.), and, consequently, in cold weather benzol solidifies in the pipes and reservoir, and the circulation is impeded. Further, when mixed with air it detonates strongly, and so it is necessary to make the engine stronger and heavier. Benzol mixes in all proportions with either petrol or alcohol, and can be so used with advantage. What is sold under the name of "white spirit" is a mixture of benzol with 25 per cent. of petrol.

Against the use of alcohol it is objected that its combustion only gives 5500 calories, whilst petrol gives 10,000, and the law compels it to be denatured; this is done by means of wood spirit and heavy benzine. In order that alcohol can compete with petrol it is necessary that it be sold at half the price of petrol. Alcohol can be made more serviceable if it is carburetted with benzol, the addition of 50 per cent. of which gives a mixture producing 8000 calories.

The same objection applies to acetylene as to benzol, *viz.*, the explosions produced by its combustion are too strong. With coal gas the loss of power is 25 per cent., as compared with the standard fuel, petrol; and there is a further and very real difficulty owing to its variable quality as produced by different works.

In the above the word "petrol" is used in the English sense; "petrol" in French is equivalent to the English "paraffin oil" (kerosene), whilst "petrol" (English) is always known in France as "essence." To English readers or English people coming to France this is often a point of much confusion and misunderstanding.

Chemical Industry of the Ukraine.—The chemical industry of the Ukraine, quite considerable before the war, is at present in a perfectly hopeless condition. Only three large factories are in operation, and these but intermittently: the alkali works of Ljubimoff, Solve and Co., the glass works of the firm Lievenhof, and the Kusnezoff Company at Lissitschansk. All acid and benzol works are at a standstill. Lack of coal, lubricating oils, raw materials, and derangement of trade constitute the formidable obstacles preventing the resumption of

work. The acid factories are dependent upon the import of iron pyrites and Chile saltpetre. The available supplies of these materials in the Ukraine are limited to 400,000 puds (pud = 36·1lb.) of iron pyrites and about 200,000 puds of nitre. There is, moreover, no immediate prospect of any imports under existing circumstances. Benzol works, with the exception of the Brjansker Works, which can supply about 3000 puds of benzol, are unable to foresee a restart of operations owing to lack of coal. Whereas during the war the whole of the benzol works could, under most favourable conditions, supply 80,000 puds of crude benzol, they could at the present time, under the best circumstances, only supply half that amount.—(*Ekonomitscheskaja Shisn, May* 7, 1919; *Z. angew. Chem., July* 25, 1919.)

REPORTS

FUEL ECONOMY.

Second Report of the Committee appointed by the British Association for the Investigation of Fuel Economy, the Utilisation of Coal, and Smoke Prevention.

During the past year the Committee has been reorganised. Members have been co-opted on the nomination of various Societies interested in the question of Fuel Economy, and three separate subcommittees whose inquiries are respectively directed towards (*a*) chemical and statistical, (*b*) carbonisation and metallurgical, and (*c*) power aspects of the question, have been constituted.

Attention is directed to the movement of coal prices in Great Britain and the United States during the war period.

Outputs of Coal and Average Pithead Prices in Great Britain.

Year.	Total output. Million tons.	Annual output per person employed. Tons.	Average pithead Price per ton.
1913	287·4	260	10 1
1914	265·6	238	10 0
1915	253·2	270	12 6
1916	256·3	260	15 7
1917	248·0	247	16 9
1918	227·7	232	24 0

Outputs of Coal and Wholesale Prices of Coal per Long Ton in the United States.

Year.	Total output Million tons.	Output per worker employed at the Mines. Tons.	Wholesale prices per long ton	
			Stove anthracite at New York.	Bituminous Pittsburg, Run of Mine, f.o.b. Cincinnati.
			s. d.	s. d.
1913	508·9	681	—	—
1914	458·5	601	21 1	10 3
1915	474·6	647	21 0	10 3
1916	526·9	732	22 9	12 6
1917	581·7	768	23 5	21 5
1918	—	—	27 1	18 1

A table giving the comparative annual outputs of coal per worker employed in the mines shows that the respective outputs in Great Britain, Germany and the United States for the period 1911—1913 were 254, 263 and 651 tons.

Prof. Bone has shown that in order to obtain comparable results concerning the chief types of constituents of various samples of coal by the action of pyridine, the solvent must be carefully dried and the action carried out in an atmosphere from which oxygen is excluded. A method has been devised for extracting in a pure condition of the resinic constituents of coal (see this J., 1919, 184R).

The Committee is apprehensive of the danger of sterilising fuel research by over-centralisation, and advocates the fuller utilisation of existing laboratories for this purpose.

Data concerning the fuel consumptions in blast furnaces, steelworks and rolling mills are to be published in the Journal of the Iron and Steel Institute shortly.

The Committee is in substantial agreement with the recent recommendations of the Fuel Research Board (this J., 1919, 191 R) concerning future standards of public gas supplies. The opinion is expressed that the fundamental properties of the explosive mixtures formed by different combustible gases with air affect profoundly their uses for power and heating purposes. The Committee suggests that gas might be sold on a thermal basis, provided that (1) its methane content is not less than 20%, (2) its carbonic oxide content not more than 20%, and (3) its contents of "inerts" not more than 12%. Moreover, the gross calorific value of the gas must not fall below 450 B. Th. U's. per cubic ft. Where gas is supplied for industrial use, a relaxation in the above conditions might be permitted.

Attention is directed to the process introduced by Dr. C. Carpenter for the purification of coal gas from sulphur compounds, and the Committee strongly supports the recommendations of the Fuel Research Board in regard to sulphur purification and the more complete removal of cyanogen componnds.

The investigations of the Committee are to be continued.

Report on "Fuel Economy and Consumptions in the Manufacture of Iron and Steel."

On behalf of the British Association Fuel Economy Committee, a report on this subject was presented to the Iron and Steel Institute at the meeting of the Institute, held on September 18, by Prof. Bone, Sir Robert Hadfield and Mr. A. Hutchinson. The main part of the report is devoted to an analysis and discussion of the replies received by the Committee from twenty-five firms in reply to inquiries addressed to them with a view to obtaining reliable data as to the present state of fuel consumption and economy in regard to blast-furnace practice and the operations of steelworks and rolling-mills. The analysis of the replies received is prefaced by a valuable historical section in which the advances made in fuel economy due to the labours of Neilson, Bunsen and Playfair, Lowthian Bell, Bessemer, Cowper and Whitwell, Snelus, Thomas and Gilchrist, Siemens, and Gayley are briefly reviewed. By the introduction of the hot blast, Neilson succeeded in reducing the coal consumption per ton of iron produced from 8 tons 1·25 cwts. to 5 tons 3·25 cwts. with blast preheated to 300° F., whilst with blast preheated to 600° F. it was reduced to 2 tons 5·25 cwts. Bell expressed the opinion that "it is useless to hope to smelt a ton of grey iron from the Cleveland stone yielding 41% of pig metal with anything notably under 20·5 cwts. of coke." Gayley, by the use of the dry-blast operating on hæmatite ores containing 53·5% of iron, reduced the coke consumption per ton of iron produced from 2260 lb. to 1815 lb. There is an apparent consensus of opinion that the introduction of the dry-blast to Cleveland practice would not be economically wise. For the achievement of the utmost fuel economy in a modern iron and steel works, concentration of by-product coke ovens, blast-furnaces, rolling-mills and steelworks on one site is essential. Thereafter the matter is one of

scientific organisation and disposition of the plant as a whole with a view to utilising the energy in the surplus blast-furnace and coke-oven gases. In the case of a works so arranged and organised, the "practical ideal" is regarded as 1·75 tons of good coking coal per ton of finished steel sections. For the attainment of this ideal the coke-ovens must be of the regenerative type, the blast-furnaces should be fitted with double bells, the gases leaving the furnace should be dry-cleaned, and the gas engines in the power house should be run thereon. Furthermore, the rolling-mills should be electrically driven, and scientific management and control should be exercised throughout by trained fuel-technologists. The heat recoverable from the molten slag appears to be about 5% of the total heat of the coke employed. The heat recoverable from gas-engine exhausts and chimney gases is the equivalent of at least 1 cwt. of coke per ton of iron. These, and losses connected with the waste gases from open-hearth furnaces and soaking-pits, together with losses originating in the idleness of the steel-plant and rolling-mills during the week-end, deserve attention.

Coming to the analysis of the replies received from the twenty-five firms aforementioned, it is pointed out that twelve of the undertakings owned blast-furnace plants only, nine both blast-furnaces and steelworks, whilst the remaining four had steelworks only. The following table gives the average coke and equivalent coal consumption in the case of undertakings smelting various brands of iron in blast-furnaces:—

Quality of Iron	Cleveland	Lin'shire	Midlands Basic	Haematite
Number of plants averaged ..	7	4	4	6
Average coke consumption per ton of iron. .. Cwt.	23·5	33·0	26·0	21·33
Average coal equivilents. .. Cwt.	32·65	47·0	37·0	30·0

The average coal equivalents per ton of iron are deducted on the assumption that the coal employed yields from 70—72% of coke when carbonised in by-product ovens. The results obtained indicate that considerable economies in current British blast-furnace practice can be effected, more particularly by (*a*) reducing losses at the bells, (*b*) more efficient utilisation of the gas employed for heating the blast, (*c*) substituting gas-driven for steam-driven blast engines, (*d*) instituting a more systematic fuel control.

The fuel consumptions in the case of open-hearth furnaces are as follows:—

	Cwt. per ton of ingots.	Average Cwt.
(a) Molten pig processes	6·00— 7.00 ..	6·35
(b) Mixed processes	6·25— 8.75 ..	7·65
(c) Cold processes	7·60—12.00 ..	9·45

"Molten pig" processes are those in which 85% of the total metal charged was made up of molten pig iron from the blast furnace, "mixed" processes those where the proportion of molten pig iron in the charge varied between 40% and 70%, the remainder being charged in cold. In "cold processes" no molten metal is charged. It appears that a large proportion of recoverable heat is lost from steel furnaces, soaking pits, boilers, etc. This could be recovered by the installation of waste heat boilers.

In the case of the Bessemer practice, the coal employed for steam-raising, at cupolas, and for heating ladles &c. amounts to about 5 tons 2·5 cwts. on the assumption of 70% of coke production therefrom.

The coke consumption for melting steel in crucible furnaces is returned as 2 tons 15 cwts. per ton of steel by one firm and as 23 tons 7·5 cwts. by another for the melting operation only. Both firms reported adversely regarding the substitution of by-product for beehive coke in crucible furnaces, and this opinion appears to be widely held in Sheffield. The opinion is one that the Committee cannot endorse or contradict, and regards it as a subject for investigation.

The concluding remarks of the report are directed to emphasizing the fact that large fuel economies can still be effected in British iron and steel works. The science of combustion appears to be imperfectly understood or very badly applied by those in charge. It is confidently anticipated that in the near future all gas employed in stoves or engines will be cleaned electrostatically. Finally, the problem of fuel economy is one rather of scientific organisation and co-ordination than of the discovery of new principles, and educational facilities should be forthcoming for the provision of competent men to undertake such organisation and co-ordination.

Eighth Annual Report by the Director of the Bureau of Mines to the Secretary of the Interior for the Fiscal Year ended June 30, 1918. *Pp.* 124. (*Washington: Government Printing Office.* 1919.) *Price* 10 *cents.*

The organisation of the Bureau consists of an administrative department, together with divisions devoted to mining, fuels and mechanical equipment, mineral technology, metallurgy, petroleum and a chemical research laboratory. During the period covered by the Report, the Bureau of Mines devoted considerable time to the investigation of problems connected with the war, and in particular the preparation of toxic gases, the large scale production of which was far in excess of the supply of shells.

It has been found that the oxidation of coke-oven ammonia to nitric acid can be achieved with comparative ease, a yield of from 93—94 per cent. of nitric acid being obtained from the ammonia oxidised. Pure platinum gauze, 80-mesh screen, was found to be the most efficient catalyst. The only serious poison apt to occur in ammonia is phosphine. Hydrogen sulphide and cyanogen of low concentration are not toxic towards the catalyst. Apparently, cyanogen can be oxidised as well as ammonia. An improved oxidation apparatus requiring no electrical heating is being embodied in a plant now being erected. It is anticipated that this plant will be the cheapest to construct and the most efficient in operation yet devised.

Considerable attention has been given to the working up and extraction of metals from low grade ores. The table herewith indicates the annual production in the United States of various minerals in the years specified:—

Mineral.	1913.	1917.	1918. (expected.)
	Tons.	Tons.	Tons.
High grade manganese ore ..	4,000	110,000	250,000
Pyrite	340,000	450,000	500,000-700,000
Chromite ..	250	40,000	
Magnesite ..	10,000	315,000	

The imports of manganese ores, pyrite and chromite in 1917 were respectively 650,000 tons, 750,000 tons and 72,000 tons. It has been ascertained that large quantities of low grade manganese ores of domestic origin are available, and the metallurgy of these ores has received attention with

a view to the utilisation of their manganese content in steel making. The electric smelting of these ores will furnish supplies of ferromanganese and silicomanganese with far less difficulty than accompanies the smelting of the ores in blast furnaces, but the use of such low grade ores will seldom be economical in normal times. Sufficient supplies for all war purposes of chromium and its ores can be obtained from internal sources, and the native supplies of pyrite can be developed to meet any possible shortage.

The possibility of obtaining elemental sulphur from zinc and copper fumes has been examined.

The output of potash from the dust of cement kilns and blast furnaces, from greensands, alunite, brines and from ores has increased rapidly. Fair results were obtained in the recovery of potash from natural silicates, but none such as to indicate that commercial schemes could be evolved for the purpose.

Concentration tests of low grade mercury ores have been made. Investigation has shown that the loss of mercury incurred in the condensation of vapours from low grade mercury ores containing only a fraction of 1 per cent. of mercury is very small. There seems to be no prospect of any considerable domestic output of tin ore.

The conditions under which tungstic acid derived from the treatment of tungsten ores may be efficiently reduced to metallic tungsten have been studied, and the results are to be published shortly. Molybdenum and uranium ores have similarly received considerable attention. A cheap and simple process for recovering zinc from a solution of zinc sulphate has been developed, with results rendering possible the treatment of low grade and complex zinc ores by leaching. The process of recovery consists in precipitating calcium sulphate from the zinc sulphate solution by addition of limestone. An excess of sulphur dioxide is subsequently added, soluble acid zinc sulphite and sulphuric acid being produced. The latter is precipitated as calcium sulphate, and on removal of the excess of sulphur dioxide from the filtrate by heating, normal zinc sulphite is precipitated. Operating in this manner, it has been found possible to recover at least 85 per cent. of the zinc from the solutions in a zinc product containing 38—43 per cent. of zinc and less than 2 per cent. of harmful impurities.

The results obtained in connexion with the volatilisation of lead from sulphide ores have exceeded the most sanguine expectations. Recovery of from 95—98 per cent. of the lead content and from 75—85 per cent. of the silver content of most of such ores can be cheaply effected. An ore containing more than 10 per cent. of sulphur is given a preliminary roast, and to the residue a mixture of calcium and sodium chlorides is added and the whole heated to 850—950°C. The lead and silver chlorides resulting are volatilised, cooled and precipitated electrically. Success has not attended attempts to volatilise zinc from sulphide ores.

The solubility of pure radium sulphate was determined as 2·1 mg. per litre at 25° C. both in water and in sulphuric acid up to 50 per cent. of acid. Radium sulphate is thus one of the most insoluble salts known. Experiments are being made to determine how much barium should be added to a poor radium ore to ensure a maximum recovery of radium. The carnotite deposits of Colorado and Utah, which constitute the largest source of radium-bearing ore in the world, will be exhausted in five or six years. The recovery of mesothorium from monazite sands has been studied with satisfactory results.

The work done on the removal of the lighter hydrocarbons of petroleum by continuous distillation is to be embodied in a report to be published shortly. In this report the thermal efficiencies of various plants are compared, and computations are presented to show the rates of heat transmission in stills, coolers, condensers, etc.

A method of warning in mines, employing a stench in the compressed air delivered to all parts of the mine, has been developed, and promises to displace the system employing electric signals.

Other activities of the Bureau include a survey of nickel deposits, investigations of by-product coking systems, the flotation process for treating ores, oil storage conditions, oxygen-breathing apparatus, fuels for aircraft, and many others.

Thirty-sixth Report of the Comptroller-General of Patents, Designs, and Trade Marks, 1918. (*London: H.M. Stationery Office*, 1919.) *Price 2d. net.*

During 1918, 168 applications were made for the avoidance or suspension of patent rights, compared with 223 in 1917, and 146 licences have been, or will be granted; in 6 cases the patents have been suspended in favour of the applicants. Of the 31 applications for the grant of licences under patents vested in the Custodian, 29 were allowed. Under an Order made on October 31, 1918, the benefit of all enemy owned patents was vested in the Custodian. Of Provisional and Complete Specifications, 21,839 were filed (19,285 in 19917), and 10,809 were sealed. There were 10,019 applications for designs, of which 9,597 were registered, and 6,968 applications for trade marks with 3,055 registrations. There are now 4 patents in force which have been prolonged beyond the normal period of 14 years. The number of patent agents on the register at December 31, 1918, was 238.

The receipts from Patents Fees were £314,431, and the total receipts £345,405, compared with £318,149 in 1917. The surplus of receipts over expenditure was £135,890, against £124,427 in the previous year.

The library was used by 65,076 persons; 6,128 new volumes were added, of which 3,729 were scientific text books or periodicals; and the total approximate number of volumes is 172,600.

COMPANY NEWS.

THE BRITISH PORTLAND CEMENT MANUFACTURERS, LTD.

The year ended April 30 last was financially the most successful in the company's history. There was a gross profit of £345,400 (issued capital £2,562,622; debentures outstanding £1,178,145), a net profit of £201,900, and the dividend on the ordinary shares was raised from 6 to 8 per cent. In addition, £78,000 was allocated to depreciation, and £91,500 was carried forward, as against £63,100 and £87,700, respectively, in the previous year.

The eighth ordinary general meeting was addressed by the chairman, Brig.-Gen. the Hon. F. C. Stanley, on September 19. On the conclusion of the Armistice, the bulk of the orders received from Government Departments was immediately cancelled, but this loss was soon made good by increased home demand and improved export business. The policy of the board is directed towards increased production, but shortage of labour, together with difficulties and delays in obtaining plant and stores, present serious obstacles to its realisation. Since 1914 the aggregate cost of labour, fuel, and repairs has more than doubled. Every ton of cement produced requires about half a ton of fuel, hence when the cost of coal rose by 6s. per ton, that of cement production increased by 3s. per ton, or rather more than this owing to the inferior quality of the coal supplied. The shortage of railway wagons is causing the gravest anxiety, and representations made to the

railway companies have been in some cases wholly without effect. There is no doubt that effective use is not being made of the available rolling stock. With regard to labour, the formation of a Whitley Council for the cement trade is well advanced, and in March last a 48-hours' working week and a week's holiday with full pay were granted to all employees. Appreciable economies should result from the closer working arrangement with the Associated Portland Cement Manufacturers (1900), under which eighteen directors have retired.

THE AMERICAN CYANAMID CO.

The report of this company states that a record output was attained in the year ended June 30 last, the total value of the sales being $6,205,400, or $10,700 more than in the previous year. Owing to increased costs, however, the net profit was $813,900 lower at $1,621,500 on an issued capital of $14,588,500; there was a loss of $163,800 on the subsidiary Amalgamated Phosphate Co., $234,000 was written off licences and patents, and the net income for the year was $1,048,800, as against $1,601,400 in 1917-18.

Until the conclusion of hostilities, practically the entire output was sold to the U.S. Government in the form of aqua ammonia, after which the manufacture of "ammo-phos" and sulphate of ammonia was promptly resumed at the New Jersey plant, and a foreign market immediately developed for all material produced. Operations at the phosphate mines were interrupted by a strike in May last.

New Registration.—*Scottish Oils, Ltd.*, has been registered at Edinburgh as a public company with a capital of £4,000,000 in £1 shares to acquire all or any of the ordinary shares of the Pumpherston Oil Co., the Broxburn Oil Co., the Oakbank Oil Co., Young's Paraffin Light and Mineral Oil Co., and James Ross and Co., Philipstown Oil Works; to acquire the goodwills, so far as they relate to Scotland, of the business of the British Petroleum Co. and the Homelight Oil Co., and certain of the assets in Scotland of the last-mentioned two companies, and to undertake all or any of the liabilities in connexion with the business in Scotland, and generally to carry on the business of dealers in and producers, importers, exporters, miners, distillers, etc. (see this J., 1919, 277 R).

GOVERNMENT ORDERS AND NOTICES.

EXPORTS.

Coal Tar Products.—The Board of Trade (Export Licence Department) draws attention to the fact that the export of—

> "Coal tar and derivatives thereof (except solvent naphtha, cresylic acid, and mixtures containing cresylic acid) suitable for use in the manufacture of dyes and explosives, whether obtained from coal tar or other sources, and mixtures and preparations containing such products or derivatives,"

is still prohibited to all destinations.

Certain coal tar products, such as naphthalene and its derivatives, toluol and its derivatives, picric acid, xylol and its derivatives, carbolic acid crystals, anthracene oil, benzol and its derivatives, cresols (ortho, para and meta) and their derivatives, were originally mentioned by name in the British list of prohibited exports, but these prohibitions have now been merged in the inclusive prohibition on the export of coal-tar products. The export of naphthalene, toluol, picric acid, and the other coal-tar products above-mentioned should therefore be regarded as prohibited to all destinations, and applications for licences to export them should be addressed in the usual way to the Controller, Export Licence Department, 1, Queen Anne's Gate Buildings, Westminster, S.W. 1.

Prohibited Exports.—The following heading has been deleted:—(B) Cotton, American.

OFFICIAL TRADE INTELLIGENCE.

(*From the Board of Trade Journal for September* 11 *and* 18.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 73, Basinghall Street, London, E.C. 2, from firms, agents or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

Locality of Firm or Agent	Materials	Reference Number
Australia	Glass	633
Canada	Dyes, paints, glue, enamel ..	595
,, ..	Iron and steel bars and plates, copper and brass bars and sheets, galvanised sheets	596
,, ..	Dyes, glass, crockery, china ..	638
,, ..	Druggists' requisites	641
,, ..	Leather for motor-car industry ..	*
Malta	Porcelain, earthenware. glass ..	603
Mauritius ..	Glass, paints, lubricating oils, motor spirit	604
New Zealand ..	Asbestos sheets, slates, white lead, paints, linseed oil	645
,, ..	Glass, china, porcelain	645A
Belgium ..	Drugs	653
,, ..	Leather, rubber, waste metals, dyes, minerals, ores, pitch, refractories, mineral, vegetable and animal fats and oils ..	†4057 T&R
Czecho-Slovakia	Chemicals, colours, china ..	656
France	Rubber, gums, linseed	610
,, ...	Metallurgical supplies	659
Italy	Palm oil, hides, skins	615
,, ...	Chemicals, cocoa	660
,, ...	Chemicals, paints, varnishes ..	661
,, ...	Weldless steel tubes, copper wire	662
Netherlands ..	Cardboard food containers ..	618
Rumania ..	Paper, leather, binder twine ..	619
Scandinavia, Finland, Russia	Grease, oils, lubricants, benzine, benzol, etc.	663
Spain	Asbestos, lubricants, paints, varnish	620
,, ..	Tinplate	621
Switzerland ..	Chemicals, metals, hides, leather	625
,, ..	Pharmaceutical goods	667
Morocco ..	Iron, steel	668
Argentina ..	Chemicals, laboratory apparatus, glass, porcelain	670
,, ..	China, earthenware, paints, varnish	671
Brazil	Heavy chemicals	672

*The Canadian Government Trade Commissioner, 73, Basinghall Street, E.C. 2.

†Belgian Trade and Reconstruction Section, Department of Overseas Trade, Regent House, Kingsway, W.C. 2.

Markets Sought.—A Canadian company manufacturing toilet preparations and perfumes desires to get in touch with importers in the U.K. Applications should be addressed to the Canadian Government Trade Commissioner.

A firm in Spain desires to get into touch with importers in the U.K. of grease, oils, petroleum, gasoline, olive oil and capsicum. [Ref. No. 665.]

TARIFF. CUSTOMS. EXCISE.

British India.—The import of all coal tar intermediates, all direct cotton colours, all union colours, all acid wool colours, all chrome and mordant colours, all alizarine colours, all basic colours, all sulphide colours, all vat colours (including synthetic indigo), all oil, spirit and wax colours, all lake colours, and any other synthetic colours of

whatever form is prohibited except under licence as from September 6. It is understood that licences will always be granted for dyestuffs and intermediates manufactured in the U.K.

British West Africa.—An export duty of £2 per ton will be levied as from October 20 upon palm kernels exported to countries outside the British Empire.

Belgium.—The regulations concerning certificates of origin are given in the issue of the *Board of Trade J.* for Sept. 11. The import duties on beer and brewing sugar have been increased.

Brazil.—The new budget law comes into force on October 1.

Canada.—Certificates of origin and interest are no longer required for goods imported from any country. Shipments may now be consigned direct to importers in Holland and Switzerland.

China.—The new tariff will be taken as the basis for calculating the duties applicable at Chinese Land Frontier Customs Stations.

Denmark.—The prohibition of the export of the following goods, *inter alia*, was withdrawn on August 6: Many metals and their ores and salts, bromine and its compounds, carborundum, emery, certain alloy of iron, fish oil, graphite, hops, matches, paper, printing inks, certain sulphur compounds (but not sulphuric acid).

France.—The export and re-export of, *inter alia*, organic manures, glucose, molasses, de-phosphorised slag, sulphate of ammonia, nitrates of soda and lime, calcium cyanamide, superphosphate of lime and chemical manures are prohibited as from August 26.

France and Algeria.—The import duties on certain kinds of paper and cardboard have been reduced as from August 28.

Germany.—Import licences are required for all classes of goods imported into German territory outside the zone of occupation. Applications for licences should be made to the Reichskommissar for Export and Import Licences, Berlin.

Italy.—With some exceptions all "luxury" goods which under the previous arrangement between the British and Italian Governments could only be imported under licence may now be imported without licence.

Morocco (French Zone).—The consumption duty on certain kinds of alcoholic liquors has been reduced.

Poland.—A Department has been set up under the control of the Minister of Supply which has the sole right to import or authorise the importation of articles of prime necessity, amongst which are many foodstuffs, oil seeds, linseed cake, malt, lard, grease, edible oils, sugar, cocoa, salt, naphtha, petroleum, matches, candles, soap, soda and shoe leather.

Spain.—An export duty has been levied as from August 20 on certain classes of hides and skins.

Tunis.—Export licences are now required for margarine, condensed milk, syrups, edible vegetable fats, oil cake, natural phosphate, bauxite, bones and soap.

United States.—General Import Licence "P.B.F. No. 37" has been extended as from August 15 to permit free importation of pig tin, tin alloys and all drugs and chemicals except those dyestuffs and other articles mentioned in the list. The list is set out in the *Board of Trade J.* for September 18 and includes sugar, salvarsan and its equivalents, and a great many coal tar crude products, intermediates and finished products as well as dyestuffs and medicinals. Potash may now be imported under General Licence "P.B.F. No. 37" from all countries except Hungary and Bolshevik Russia.

TRADE NOTES.

BRITISH.

Trade of Trinidad in Drugs and Medicines.—The importing and selling of drugs and medicines in Trinidad is practically in the hands of five large druggists in Port of Spain. Competition is keen, but the trade is profitable. Most of the drugs and medicines imported into this colony are of American manufacture. The total value of all dutiable drugs and medicines imported into Trinidad and Tobago in 1917 was £21,000, and of those admitted free of duty for the use of the Colonial Government, £3,500. The sources of these imports were as follows:—United Kingdom 37·5%, United States 44·2%, Canada 7·6%, France 4·4%, and other countries 6·3%. In the same year 3604 galls. of medicinal spirits, valued at £6,000, was imported. Of this amount 24·4% came from the United Kingdom and 75·0% from the United States. The duty on drugs and medicines is 10 per cent. *ad valorem*, and the duty on medicinal spirits is 5s. per gall.

Although medicinal plants can be grown in Trinidad, there has been little attempt to prepare medicines locally. Castor seed cultivation has been stimulated, but local attempts to express oil from the seed for medicinal purposes have not met with much success. The difference in tariff on medicinal spirits and medicines already compounded when imported makes it advantageous to the Trinidad druggists to import medicines containing alcohol ready made rather than make up their own.

Malaria is very prevalent in the rural districts of Trinidad, and, together with diarrhoea and enteritis, is the cause of a large number of deaths. Phenacetin and aspirin are in considerable demand. —(*U.S. Com. Rep., Aug.* 6, 1919.)

FOREIGN.

The Chemical and Allied Industries of Italy:—*Oils and Fats.*—The following figures indicate the extent of the Italian trade in olive oil during recent years:—

	Hectolitres. 1909-13. (Average	1914.	1916.
Production	1,813,000	1,784,000	2,062,007
Imports	46,164	205,508	190,982
Exports	453,080	324,837	66,260

IMPORTS OF OILS, SEEDS, SOAP, ETC.

	Metric tons. 1914.	1917.
Linseed oil, boiled	376	2,672
Linseed oil, other descriptions	372	
Cottonseed oil, fine	2,388	242
Coconut oil	3,878	1,421
Palm oil	6,977	7,770
Arachis oil	2,806	2·4
Olive oil	15,422	10,370
Fish oil	4,502	6,883
Oleic acid	6,339	1,227
Various fats	23,354	15,570
Castor seed	9,380	7,200
Linseed	32,380	22,565
Colza seed	21,980	2,158
Sesame and arachis	28,863	16,000
Soap, ordinary	4,092	5,124
Soap, toilet	172	201
Colophony	14,959	19,061
Glycerin	334	4,189

Glycerin.—During the war the prohibition of the use of unsplit fats for soap making led to a considerably increased production of glycerin, and the Oleifici Nazionali of Genoa erected large glycerin works at Leghorn.

Soap.—The average home production amounts to 150,000 metric tons of ordinary and 40,000 tons of

fine soap; the imports (chiefly from Marseilles) to 6000 tons and the exports (before the war to England and North America) to 3500 tons a year. Exportation to England appears to be excluded in the future owing to the high cost of fuel in Italy and to the favourable position of the English factories with respect to raw materials. In 1911 soap makers secured a rebate of duty on imported arachis oil to enable them to compete with Marseilles, but this privilege has not been used since the customs authorities required the oil to be denatured. Taxes were imposed in 1917 on the manufacture and sale of soap (40 and 120 lira, respectively, per 100 kilo. of ordinary soap). The Italian soap industry has lately used much bone fat of which about 25,000 tons was imported in 1913.

Stearin and Candles.—The yearly export of stearin, made chiefly from fish oil, is about 2200 tons; of stearin candles about 300 tons; and (1913) of paraffin and mixed candles about 2108 tons.

In 1911, 611 firms (using 1800 h.p.) and 5000 persons were engaged in the glycerin, soap, stearin and candle industries which are therefore for the most part carried on on a small scale.

Paint and Varnish.—Most of the 2000 varnish works are small; the 30 larger factories use about 1000 h.p. and employ 800 persons in all. Exports in 1913: 200 metric tons, of which 150 tons was oil varnish.

Imports in 1913.

Description.	Metric tons.	Source.
Varnish (other than oil and spirit)	2000	Germany 37%; France 30%; U.K. 25%
Spirit varnish	15	—
Oil varnish	1000	U.K. 35%; Germany 30%

Margarine.—About 8000 tons of inferior quality is produced annually in peace time. Exports: about 200 tons. Imports: very small.

Perfumery.—Notwithstanding the large native production of lemon, orange, bergamot and other essential oils, the perfumery industry is but feebly developed owing to the taxation of alcohol and to the necessity in this trade for long-continued and expensive advertising. Fine perfumes are not made in Italy. The Italian Government is likely to foster the essence industry and to organise it better. Exports (1913): Perfumes, 1 million lire; essences (chiefly lemon) and citric acid, 2·75 million lire.

Imports in 1913.

	Million lire.	Source.
Non-alcoholic perfumes	1·123	France 67%; Germany 33%
Alcoholic perfumes	1·5	—
Essences	3·0	Germany 67%

Building Materials.—The following figures are for 1913 and partly for 1912:—

Material.	Production.	Imports.	Exports.
	Metric tons.		
Quicklime	895,478	6,663	9,440
Slaked lime	641,400	2,532	9,861
Gypsum	421,538	4,246	2,157
Cement	1,091,976	17,220	49,736
Fireclay brick	24,000	56,436	—

Sixty per cent. of the fireclay brick came from the United Kingdom. Several companies have recently been formed for the manufacture of furnace bricks and similar products, notably one in Milan with a capital of one million lire.

Ceramic Industries.—The total production of majolica, porcelain and terra cotta in 1913 was about 88,721 tons and the exports were insignificant. The majolica industry has sunk to an imitative handicraft, but in the porcelain industry, which shows vigorous life, the exports (1914: 4011 metric tons) are increasing somewhat and electrical insulators of tolerable quality are being made.

Glass.—The total production is about 90,000 metric tons. The small export trade is chiefly of Venetian beads, glass paste, etc., to British India. There are 78 small glass works with more than 10,000 workers; 30 for *articles de luxe* with about 1000 workers and 7 larger limited companies (only 3 dividend-paying) with 11·5 million lire capital. The chief centres of the industry are at Pisa (St. Gobain), where optical glass has been made since the outbreak of war, and Milan. A new company (capital, 0·5 million lire) has been formed at Murano for the manufacture of scientific glassware. The principal products of the Italian industry (which suffers from lack of coal) are the typical wine containers of 1 to 50 litres capacity, and bottles which are also imported (6800 metric tons, of which 3500 came from Germany). The following figures are for 1913:—

Description.	Production.	Imports.	Exports.
	Metric tons.		
Glassware (various)	62,565	10,665	1,227
Sheet glass	19,650	3,079	415
Art objects	1,943	115	154
Beads, etc.	4,500	125	3,950

Artificial Silk.—Before the war this was made only by one large firm, the Cines Company (capital 5·75 million lire), which is also the largest manufacturer of films in Italy. Several new works are said to have been erected during the war.

	1913.	1915.	1916.
	Metric tons.		
Imports	357·3	365·7	139·8
Exports	152·7	697·0	323·1

Paper.—War conditions have proved profitable to the Italian paper industry, which previously could not stem the flow of imports from Germany and Austria, although well able to supply home requirements. The employment of cheap water power, of which the paper works use about 40,000 h.p., has assisted progress in the production of mechanical wood pulp, of which, in 1914, only 10,000 metric tons was imported, whilst 60,000 tons was produced. The systematic planting of suitable trees is in progress, but there are only three factories for chemical pulp, and these, partly owing to the difficulty in procuring sufficiently cheap wood or Esparto grass, provide only one-ninth of the 90,000 metric tons required annually. The small export of paper from Italy is confined almost wholly to cigarette paper for the East and to some fine paper for South America. About 100 million lire is invested in the Italian paper industry, which possesses about 230 continuous paper machines and employs about 28,000 workers.

Cork Bark and Corks.—Cork is produced in Sardinia (the best product), Sicily and the Maremma. Exports of crude bark in 1913 were 4641 metric tons, and imports, 632 tons. The imports of cut bark are about 600 tons. Practically no prepared bark is exported.

Sugar.—This industry began on a large scale in 1888, but the Italian market was almost completely closed by the action of the Brussels Convention. Heavy taxation accounts for the high price of sugar in time of peace (1·5 lire per kilo.) and possibly for the low consumption per head of population (5 kilo. a year in Italy, 40 in England, 20 in Germany, and 17 in France).

Statistics for 1913.

Production of sugar beet	2·7 million metric tons.
Capital of 25 largest factories	100 million lire.
Workers in " "	15,500
Power " "	25,000 h.p.
Imports of refined sugar (Bohemian)	7,000 metric tons.
Exports of refined sugar	1,000 "

In 1913 experiments were in hand on the cultivation of better varieties of beet and on the utilisation of the neglected by-products.

An increased exportation during 1915 and the subsequent diminished production (75,000 tons for 1917-18) brought about a sugar famine and in 1918 the price rose to 3·55 lire a kilo (1s. 3d. per lb.).

Glucose.—The annual production is about 6,500 tons, chiefly by a Milan company. The imports and exports are insignificant.

Wines, Etc.—The average yearly production of wine is 40 million hectolitres and the exports are about 1·3 million hectolitres. In the year 1913 there were exported, 4263 metric tons of wine yeast, 8294 of crude tartar, 2846 of tartaric acid, 318 of cream of tartar, and 356 of vinegar.

The vinegar industry is little developed and the larger factories (in Bologna) are of Austrian origin.

Brewing.—In 1913, 652,000 hectolitres of beer was produced, partly by Italian and party by German undertakings. Imports were 86,000 hectolitres (including bottled beer), 90 per cent. of which came from Germany and Austria.

Alcohol and Spirits.—The production in 1913 was 372,584 hectolitres, of which 177,500 was from sugar and 130,000 from grain. The exports (chiefly to North and South America) are valued at 7·5 million lire and the imports at 1·23 million lire, including more than 1 million lire for cognac.

The following particulars relate to purely chemical and gas companies, and exclude those dealing with metals, textiles, paper, glass, etc. At the end of 1915 there were 102 companies possessing a combined capital of 286·7 million lire; debentures totalled 62·3 and reserves 75·1 million lire. Eighty-nine of the companies earned a total profit of 47·7 and 13 companies a loss of 3·5 million. (*Z. angew. Chem. June* 24, 1919).

Phosphate Deposits in Morocco (French Zone).—The phosphate mines at El Boroudj will probably be put to public tender early next year. It is expected that the concession will call for 100,000,000 francs capital. The Protectorate will welcome British or any capital likely to work the deposits on a large scale. A French company is preparing to tender. Analyses of the deposits and geographical and transport particulars may be obtained by British interests from the Near East Section, Department of Overseas Trade, 4, Queen Anne's Gate Buildings, Westminster, S.W.1.—(*Bd. of Trade J., September* 4, 1919.)

Exports of Chemicals from Norway.—The following figures taken from the Norwegian Official Statistical Bulletin of December, 1918, show the exports of chemicals (in kilo. of 2·2046 pounds) from Norway during 1918, in comparison with those for 1917:—

Chemicals.	1917. Kilo.	1918. Kilo.
Nitric acid	1,621,170	836,686
Oxalic acid	334,089	206,028
Sulphate of ammonia	50,000	—
Nitrate of ammonia	63,578,120	49,587,663
Sodium nitrate	22,711,200	2,636,553
Sodium nitrite	3,536,090	2,097,811
Norwegian saltpetre	35,932,400	53,625,250
Cyanamide	2,312,910	10,490
Calcium carbide	46,066,630	41,771,876
Iodine	1,180	5,373

Exports of matches were given as 5,014,918 kilo. in 1918, as compared with 4,044,680 kilo. in 1917; ferrosilicon, 29,449,710 kilo., against 16,861,278; and gunpowder and other explosives, 1,130 kilo., against 11,667.—(*U.S. Com. Rep., Aug.* 22, 1919.)

Aluminium Food Containers.—The use of leaden containers for foodstuffs, drugs, and cosmetic preparations has been repeatedly condemned as dangerous or unhealthy by the Imperial Board of Health. The injurious consequences accompanying their use can be avoided by employing aluminium, which possesses all the essential properties, viz., homogeneity, pliability, and compressibility without fracture. A brochure relating to such containers made of pure aluminium and detailing their dimensions and cubical content is being circulated by the Fritz Neumeyer A.-G., Nürnberg 130, and is of particular interest by reason of the original patterns described therein.—(*Z. angew. Chem., July* 18, 1919.)

Dyestuffs Standards for China.—Practical dye-men and Hong-Kong importers of dyes report that the chief factor in the future of the sale of dyes in China is the standardisation of colour shades. One of the chief elements of the success of German dyes in this field was that certain shades popular among the Chinese could be relied upon. The matter of colour is very important among the Chinese. Many of the colours have special significance of a ceremonial sort as well as being regarded as more or less lucky or unlucky. There are large interests in China, especially in Amoy, Swatow, Chuchow, and various South China coast cities, where imported shirtings and sheetings are dyed for sale to the Chinese. The basis of this entire business is the quality of colour in the cloths thus handled, which depends on the uniformity of colour and the quality of the dyes.—(*Bd. of Trade J., Sept.* 11, 1919.)

REVIEWS.

Explosives. *By* E. de Barry Barnett. Industrial Chemistry, *edited by* Dr. S. Rideal. *Pp. xvi + 241. (London: Baillière, Tindall and Cox,* 1919.) *Price* 12*s*. 6*d*. *net*.

Those who are engaged in the manufacture of explosives will find nothing new or striking in this book, either in fact, observation, or theory; but it will be of considerable value to everyone interested in technical chemistry who wishes to obtain general information as to the present position of the various branches of the explosives industry. The book has been clearly and concisely written, but there is a marked inefficiency in punctuation, and several of the sentences might have been rewritten with advantage. The author has compressed a large amount of reliable data into 233 pages, and the information has been brought up to date by including the official figures for the cost of producing various explosives during 1918.

In the introductory historical section a useful summary is given of some points in the Explosives Act, the method of construction of danger buildings, and the means taken to ensure, as far as possible, the safety of workpeople. Gunpowder is dealt with in a short section. This country has always had a justifiably high reputation for the quality of its gunpowder, and it is not generally recognised that this has been due, in no small degree, to the hereditary art of the gunpowder maker.

Nitroglycerin, guncotton and nitro-aromatic compounds are treated on familiar lines. The author makes no reference to the modifications made during the war in cotton cellulose and the methods of chemical purification. In dealing with nitro-cellulose waste acid, it is stated that "The residual sulphuric acid still contains 2—3 per cent. of nitrous acid which cannot be removed by distillation, and it is denitrated by steam." Such conditions are certainly quite exceptional, as the general experience is that the residual sulphuric acid contains only the merest trace of nitric and nitrous acid, and has not to be denitrated with steam before concentration. During the war the Gaillard tower has been much more extensively used than is indicated by the author. The available literature on military smokeless propellents is very extensive, and a good résumé has been made of this work.

On page 71 the author confers a knighthood on Alfred Nobel and then credits him with investigations on cordite which were carried out by Sir Andrew Noble. In dealing with smokeless sporting powders the author is naturally handicapped by the fact that there is no published information on the methods of manufacture of some of the most prominent of the English sporting powders. Long experience and investigation have led to the use of special types of nitro-cellulose, special solvents and special methods of manufacture. For many years the methods of manufacturing gelatinous and granular blasting explosives have altered very little. The problems in this branch are connected with decrease of velocity of detonatiou and the development of inertness after prolonged storage, and the investigator has to deal with many intricate problems in the chemistry of colloids.

The author is hardly correct in his statement that the Werner Pfleiderer machine is usually preferred for incorporating gelatinous blasting explosives, seeing that the McRoberts machine is almost universally employed in this country.

A good selection has been made from the published literature on explosives for use in coal mines, and the experimental galleries at which they are tested.

The author has correlated many of the explosives on the British permitted list, and expressed his opinion as to the influence on the maximum charge of difference in composition, nature of wrapper and method of manufacture.

The reviewer has been closely associated with the experimental work connected with several of the explosives on the permitted list. The longer his experience, the less is his inclination to form definite opinions as to the relative influence of the many factors which are known to affect the test.

Other sections deal with percussion caps, detonators and fuses, matches and pyrotechny, and the testing of explosives.

In the concluding section the author endeavours to forecast the future developments in the explosive industry. G. W. MacDonald.

The Analysis of Minerals and Ores of the Rarer Elements. *By* W. R. Schoeller *and* A. R. Powell. *Pp. x* + 239. (*London: C. Griffin and Co.*, 1919.) *Price* 16*s. net.*

The exigencies of the war have led to a much wider recognition in this country of the many industrial uses for the rarer elements and their compounds. Although several books have appeared on the occurrence and utilisation of these substances, in all these works the analytical examination of their ores has either been ignored or dealt with in a very brief manner. Text-books on analytical chemistry also failed to meet the requirements of the mineral chemist called upon to analyse such material for the first time. The present volume is therefore particularly welcome, as it fills the gap in a very concise and yet adequate manner.

The introductory chapter deals first with various manipulative details, and then considers briefly the mineralogical examination of the material, and in this connection the authors rightly emphasize the need for a good knowledge of mineralogy to chemists who are called upon to deal with economic problems in regard to the treatment of ores of the rarer elements. After giving numerous tables for the qnalitative examination of the minerals the quantitative analysis is discussed. The elements thus considered are lithium, rubidium, caesium, beryllium, radium, scandium, gallium, indium, thallium, cerium and its allies, titanium, zirconium, thorium, germanium, vanadium, columbium, tantalum, selenium, tellurium, molybdenum, tungsten, uranium, ruthenium, rhodium, palladium, osmium, iridium and platinum.

The principal theme of the volume is complete quantitative analysis, the general schemes for which are given largely in tabular form, whilst the behaviour of individual elements is considered in detail. The authors frankly invite discussion and criticism of the methods of separation and estimation recommended, but only very occasionally is one inclined to join issue. In the case, however, of the mineral thorianite (p. 111), its decomposition by fusion with bisulphate as recommended appears to be undesirable in view of the fact that the mineral decomposes very readily with boiling nitric acid, thus avoiding the introduction of alkaline sulphates into the rare earth solution, and, at the same time, effecting a separation from such minerals as zircon, quartz, rutile and much of the ilmenite. Greater stress might also be laid upon the disturbing influence of titanium compounds upon the solubilities of those of tantalum and columbium—*e.g.*, in the separation of tantalum as potassium fluo-tantalate, and as affecting the insolubility of the oxides in water after fusion with bisulphate of potash.

Numerous footnote references are given to original papers, and in place of the customary subject index we have two—(*a*) an index to minerals, (*b*) index to separations.

To the investigator who has not an extensive reference library at his disposal, the value of future editions of this book might be enhanced by the inclusion of a few tables showing typical complete analyses of the more common rare earth minerals; as it stands, however, the work should prove of value to all chemists who may be called upon to examine minerals and ores of the rarer elements as it appears to be a distinct advance on anything previously published on the subject, either in this country or abroad.

Sydney J. Johnstone.

PUBLICATIONS RECEIVED.

A Treatise on British Mineral Oil. (*With a foreword by* Sir Boverton Redwood). *Edited by* J. A. Greene. *Contributors:* E. H. Cunningham-Craig, W. R. Ormandy, F. Mollwo Perkin, A. Campbell, A. E. Dunstan, *and* A. H. Seabrook. *Pp.* 233. (*London: C. Griffin and Co.* 1919.) *Price* 21*s.*

Principles of Electric Spark Ignition in Internal Combustion Engines. *By* J. D. Morgan. *Pp.* 88. (*London: Crosby, Lockwood and Son.* 1920.) *Price* 8*s.* 6*d.*

Journal of the Royal Agricultural Society of England. *Vol.* 79. *Pp.* 284 + xxxix. (*London: John Murray.* 1918.) *Price* 10*s.*

The Conditions that Govern Staleness in Bread. Changes of Moisture and Soluble Extract with Age. Investigations and Researches Made in the British Army Bakeries in France, 1917-1918. *By* Capt. R. Whymper. *Reprinted from "The British Baker." Pp.* 72. (*London: Maclaren and Sons, Ltd.* 1919.)

Notes of Ten Introductory Lectures on Organic Chemistry with Special Reference to Coal. *Bulletin* 1. *Pp.* 32. (*Lancashire and Cheshire Coal Research Association.* 1918.) *Price* 1*s.*

Chemicals and Allied Products Used in the United States. *Prepared by* The Bureau of Foreign and Domestic Commerce, *in collaboration with* The American Chemical Society. *Compiled by* E. R. Pickrell. *Miscellaneous Series—No.* 82. *Pp.* 194. (*Washington: Government Printing Office.* 1919.) *Price* 25 *cents.*

THE HISTORY OF "MUSTARD GAS."

ARTHUR G. GREEN.

In the article by Sir William Pope in the "Review" for September 30 he complains somewhat sarcastically that the process of "mustard gas" production devised by himself and Mr. C. S. Gibson became known as the "Levinstein process," and later as the "American method," and he is seriously perturbed by the possibility that it may eventually be termed in Central Europe the "German method."

Although I am the last to wish to depreciate the valuable services rendered to the nation by the work of Sir William Pope and his collaborators, yet the facts as hitherto presented leave an impression which, in the interest of historical accuracy, cannot remain uncorrected.

In the first place, it must be pointed out that Guthrie, to whom the discovery of mustard gas is usually attributed,* actually obtained it in 1861 by the identical reaction, *i.e.*, the combination of ethylene with sulphur monochloride (see J. Chem. Soc., 1861, 13, 134), which Sir William Pope now claims to be "entirely novel" and to have been discovered by Mr. C. S. Gibson and himself. It is true that Guthrie ascribes to his product the composition of a disulphide $(C_2H_4)_2Cl_2S_2$, and regards it as different from the product of reaction of ethylene with sulphur dichloride, but his description of the compound as a pale yellow liquid of sp. gr. 1·346 at 19° C., the vapour of which attacks the eyes powerfully and "a drop placed on the tongue destroys the epidermis," leaves no doubt but that he actually had in hand the same material as that manufactured by Levinstein, Ltd., and adopted as the British "Mustard Gas." It is still an open question whether this material, which has the empirical composition $(C_2H_4)_2Cl_2S_2$, and the formation of which is expressed by the equation:—

$$2C_2H_4 + S_2Cl_2 = (C_2H_4)_2Cl_2S_2 \text{ or } (C_2H_4)_2Cl_2S + S$$

is to be regarded as a "pseudo-solution" of sulphur in the monosulphide $(C_2H_4)_2Cl_2S$, or whether it is not rather a loose chemical combination of the monosulphide with an atom of sulphur, such a union [of S with S] being a form of combination not infrequently met with in organic sulphur compounds. Personally, I incline to the latter hypothesis. The facts are that although the sulphur may be removed by distillation, other means of separation fail, and the sulphur atom still remains dissolved or combined even after the material has been kept for many months, and this in spite of the fact that the ordinary forms of sulphur are nearly insoluble in the cold monosulphide. Moreover, if a further quantity of sulphur be dissolved in the "disulphide" at 100° C., this additional sulphur crystallises out again upon cooling the liquid, and in the quantity added, whilst the so-called "colloidal" or "atomic" sulphur still remains dissolved. This "disulphide" mustard gas, discovered by Guthrie, worked out technically by the Research Department of Levinstein, Ltd., and first put into practical manufacture at the Blackley Works, is the *only* form of mustard gas which has proved capable of production in large quantities in a comparatively simple plant and without grave risks to the workers. After the initial prejudice had been overcome, this process was adopted by the British and American Governments. The reason for this was the discovery that the "disulphide" (or pseudo-solution of sulphur in monosulphide) has a physiological activity fully equal to a molecular quantity of the pure monosulphide, whilst the enormous technical difficulty of handling separated sulphur is entirely obviated in this method of manufacture. Thus, with a well-designed and properly constructed plant there is little more danger in producing "Mustard Gas" in quantity than any other poisonous chemical. The process employed was the result of a careful study of the conditions of reaction between ethylene and sulphur monochloride, more especially as regards the effect of temperature, reacting surface between liquid and gas, manner of presenting the reacting materials, dryness of the ethylene, etc. When the correct conditions are observed, the product is obtained in almost theoretical yield as a pale yellow liquid which deposits no sulphur and requires no further treatment. To put these conditions into effect the Levinstein "reactor" was devised, a form of apparatus ironically described by Sir William Pope as "a cast-iron pot rather deeper than the ordinary lavatory basin." As we are unfortunately precluded on public grounds from publishing the plans of this plant and thus enabling the reader to judge for himself, I can only say that the engineering problems encountered in the design of the "reactor" were no slight ones, and the final apparatus evolved with its complicated system of cooling pipes, high-speed agitators, safety seals, gas inlet and outlet pipes, "fool-proof" cocks, and other devices, was as far removed from Sir William Pope's description as a modern railway engine is from James Watt's tea-kettle.

Whether the Levinstein process constituted or not a "patentable novelty" need not be discussed here. Contrary to Sir William Pope, I am strongly of opinion that it did, but we never had the slightest idea of patenting an invention upon which the life of the nation at one period almost seemed to hang. On the contrary, throughout our work all our information was given unreservedly both to our own and to the allied governments.

Returning now to Sir William Pope's process, it is necessary to point out that in contradistinction to ours the separation of sulphur was here specifically *aimed at* in order to obtain as far as possible the *monosulphide* $(C_2H_4)_2Cl_2S$, which alone was regarded as mustard gas. In the description of the process given to me by Sir William Pope himself in April, 1918, it was stated that the reaction was performed at a temperature of 60° C. (at which

* The early history of this subject is somewhat involved. Prior to Guthrie, the formation of a disagreeably smelling fluid by the action of ethylene upon chloride of sulphur had been observed by Despretz (Ann. Chim. et Phys., **22**, 428), though its vesicant action was not noted. Guthrie, in his paper in 1860 (quoted by Sir William Pope) mentions the vesicant action of the product formed by combination of ethylene with sulphur dichloride, but on the evidence of his analyses, attributes to the body the constitution $C_2H_4SCl_2$. In the same year, but bearing the date December, 1859, there appeared in Liebig's Annalen (1860, **113**, 288) a paper by Niemann in which is described the reaction of ethylene upon "brown" chloride of sulphur (a mixture of sulphur monochloride and dichloride). The following is a translation of this author's account of the toxic action of his product:—"The most characteristic property of this oil is also a very dangerous one. It consists in the fact that the minutest trace which may accidentally come in contact with any portion of the skin, though at first causing no pain, produces in the course of a few hours a reddening and on the following day a severe blister, which suppurates for a long time and is very difficult to heal. Great care is therefore requisite in working with this compound." This product, for which the characteristics of mustard gas are here so clearly set forth, is, according to Niemann's analyses, the disulphide, $(C_2H_4)_2Cl_2S_2$ and hence is apparently identical with the disulphide obtained by Guthrie in the following year from ethylene and sulphur monochloride.

temperature it may be noted in passing there is, when working in iron vessels, a large amount of chlorination and consequent production of inactive by-products); only a moderate agitation was employed, and no importance was attached to the use of dry ethylene. The sulphur, which was stated to crystallise out at the end of the process in approximately atomic proportion, was to be removed mechanically and, with or without previous washing with a solvent such as carbon tetrachloride, was to be employed again for making sulphur monochloride. This process failed completely in practical application owing to the extreme danger and difficulty of removing the sulphur.

Although we have always fully recognised the great assistance which we received by being placed *au courant* with Sir William Pope's experiments, yet the process finally evolved at our works was, as I have shown elsewhere, essentially different in principle from Sir William Pope's process and cannot be described as a large scale application of the latter. It should, indeed, be more correctly regarded as a technical development of the original process of Guthrie. Great as is the credit due to Sir William Pope in directing attention to this reaction, it is an unfortunate fact that the only serious modification made by him in Guthrie's process, *viz.*, the attempted elimination of sulphur, was the very point which rendered the scheme technically impracticable.

It must also be remembered that Pope and Gibson were not the sole workers in this field, for during the autumn of 1917 and the early months of 1918 the action of ethylene upon both chlorides of sulphur was being actively studied by several other chemists. From discussions with some of these at the University of Manchester we received much helpful inspiration.

That at this period Sir William Pope was far from accepting our results as a technical realisation of his laboratory experiments is proved by the fact that it was a considerable time before our statements were credited by him and by the scientific advisers attached to the Government. These gentlemen maintained that the separation of sulphur was an essential part of the process, without which only an inactive disulphide would result. Our product, in fact, was not mustard gas at all. Even when we had convinced Mr. Gibson by a practical demonstration (which, unfortunately, involved his detention in hospital for several weeks) of the correctness of our contention, Sir William Pope still remained sceptical for a time, and when we were pushing forward our preparations to commence the manufacture in bulk, we received from the responsible official of the Government Department concerned the following telegram (dated May 11, 1918):—

> "Referring your letter 9th you are labouring "under misapprehension, as I certainly did not "instruct you proceed manufacturing HS. "Product which you propose making as described "in your letter is I think quite unsuitable. "Take no further steps to manufacture HS. "Wait my letter even date."

Thus, at this critical and urgent period when our soldiers were dying by thousands and the fate of the nation lay in the balance through our inability to reply to the German mustard gas attacks, not only was no call made for the expert help of the dyestuff industry, but even when this help was freely offered it was brusquely declined by a Government Department. Such treatment would have deterred many firms from proceeding further, but knowing the great national need and the certain failure of the method suggested by Sir William Pope, we continued to push on with the erection of the plant at our own risk, and eventually, as everyone knows, the process was adopted as the standard method of manufacture by both the British and American Governments. Sir William Pope says that "of course" our process was communicated to the United States. This was not the view taken by the American Government, who, in officially recognising that our process was the best, expressed great appreciation of the fact that the details of our process and the plans of our plant were placed freely at their disposal without any question of royalty, the more so, they say, as "we have not always had such success."

I assert, without fear of contradiction, that had it not been for these investigations carried out at a dyestuff factory, the process of manufacturing mustard gas from sulphur monochloride would have remained a technical failure, and even if the country had been able to produce mustard gas at all, it would only have been in small quantities and at the cost of heavy casualties. The work of many people contributed to the final success, and without the contributions of others the efforts of Sir William Pope and Mr. Gibson must have remained unrecognised and unrewarded.

To the thinking man who has followed the development of poison-gas offensive during the past four years it must be obvious that we are only at the beginning of this form of warfare, and that the most serious menace to peace in the future may be the secret development by an aggressive Power of the means of preparing and using highly toxic chemical compounds. Only by keeping our national laboratories in active order can we provide against this danger.

GEOCHEMISTRY AND THE WAR.*

P. G. H. BOSWELL.

The borderland between chemistry and geology is a wide country but imperfectly explored. It seems that the stress of war was needed before its little-known tracks could be re-trodden and extended. The co-operation of pioneers pushing forward from both sides the border has led to the clearing away of much of the undergrowth of doubt, and to the consequent discovery of alternative routes and new paths to knowledge. Many of these essays into the unknown have been admittedly exploratory and opportunist; others have resulted in the discovery of ways and means the value of which ensures their permanent retention. In either case the results have justified the early work, and serve to emphasise the benefit accruing to the community from the co-operation of the chemist in the laboratory and the geologist in the field.

The question as to the exact scope of the subject of geochemistry is perhaps a debatable one. A well-known American authority[1] has expressed his view of the functions of the geochemist thus:—"To determine what changes [in the rocks constituting the earth's crust] are possible, how and when they occur, to observe the phenomena which attend them, and to note their final results . . ." In the course of pleas made recently for the establishment of a geochemical institute in this country, the connotation has been extended to include not only the chemical investigation which is required before such problems can be solved, but also chemical research dealing with and controlling the industrial uses to which rocks and minerals may

* Communicated by Section B (Chemistry) of the British Association for the Advancement of Science.

[1] F. W. Clarke, "Data of Geochemistry." U.S. Geol. Surv. Bulletin No. 616, 1919, p. 10, 3rd edition.

be put. As would be expected, the industrial application of our knowledge of geological raw materials has been the outcome of pure scientific research. On the other hand, in the course of the solution of practical problems much information of real value to the man of "pure" science has accumulated, and in due time the results will become available.

One outcome of these extended geochemical investigations has been the replacement of certain rock and mineral substances, hitherto imported from abroad, by British materials—either precisely similar in character or as substitutes "just as good," at times distinctly better, and at other times of the character of makeshifts. Not only was shipping thus relieved, or, in the case of certain substances of enemy origin, deprivation overcome, but at the time of the great strain upon internal means of communication and transport it was found possible to indicate suitable sources of raw materials close to works requiring them. In this way carriage was reduced and coastal trade and railway transport diverted into less congested areas.

Shortly after the outbreak of hostilities many British industries connected with the output of munitions or the maintenance and increase of food supplies found themselves wholly or in part deprived of certain essential raw or "semi-manufactured" materials of mineral origin. As examples may be mentioned the key industries of glass-making and steel manufacture (in particular, steel-founding), which suffered from the shortage of potash, glass-sands, moulding-sands, etc., besides other chemical materials made from mineral products. In connexion with food supply, the lack of nitrates, potash-salts, and phosphates became acute. The chemists solved the nitrate difficulty by the fixation of atmospheric nitrogen. The investigation by the geologists and mining engineers of home supplies of potash-bearing minerals, such as felspar, and the recovery by the chemist, in co-operation with the geologist, of potash from blast furnace flues in Britain and cement-kiln flues in America, temporarily overcame the difficulties produced by the absence of German salts. The coprolite-bearing deposits of the Cambridge greensand were, after some delay, opened up for the purpose of obtaining the contained phosphate of lime, and at the date of the armistice were yielding helpful supplies.

The impetus given to the working of home supplies of metallic minerals such as the ores of iron, copper, lead, zinc, tin and tungsten, and of veinstones like barytes, fluorspar and quartz, are familiar to all. The treatment of the ores and the manufacture of "intermediate" products like ferro-tungsten demanded the co-operation of the metallurgical chemist.

It would perhaps be impossible in a paper of this length to give a list of all the mineral and rock substances, from antimonite, used for fulminate compositions, for percussion detonating, to zirconia, required for refractory and alloy purposes, which have been indispensable for the successful prosecution of the war.

From a perusal of the publications issued during the war by the Geological Survey (Special Reports on Mineral Resources),[2] the Ministry of Munitions[3], Department of Scientific and Industrial Research[4], and the Imperial Institute[5], some conception may be obtained of the increased, if belated, attention which has been paid to economic geology at home. In the publications of certain technological societies, such as the Faraday Society, the Ceramic Society, the Society of Glass Technology, the Foundrymen's Association, the Institution of Mining and Metallurgy, and the Society of Engineers, may be found even more useful information regarding the treatment and behaviour, as well as the resources, of materials like fireclay, ganister, zirconia, felspar, moulding-sands, glass-sands, etc. The manufacture of silica-bricks, magnesite and dolomite-bricks, fireclay-bricks and blocks, glasshouse pots, glass itself, etc.,[6] and their behaviour in the furnace at high temperatures, provide interesting parallels with the phenomena shown by rocks which suffer transformation in or below the earth's crust. G. V. Wilson has shown, for example, that the erosion of a glasshouse pot by the molten glass contained in it is reduced appreciably by the formation in quantity of the mineral sillimanite ($Al_2O_3.SiO_2$) in the surface l yers of the pot. It has also been discovered that holes are originated where small pellets of the impurity, iron pyrites, occur in the walls. Geochemical research has shown that the quality of silica-bricks made by burning, at a temperature of over 1300° C., a ground-up mixture of ganister and other siliceous rocks, with 1 per cent. of milk of lime as a bond, may be appreciably improved by burning the bricks for a longer period at a higher temperature than was previously the practice. Greater inversion of the quartz to other low density forms of silica occurring occasionally in rocks, and known as tridymite and cristobalite, was thus ensured, with the consequence that less expansion of the brick subsequently occurred when it was set in the furnace.

For the successful laying down of specifications for refractory materials for particular purposes, a task which was undertaken before the war by the Gas Engineers, and during the war by the Society of Glass Technology and the Iron and Steel Institute, a large amount of geochemical research was, and is still, required. Cognate problems were met with in the production of laboratory porcelain, hard paste, etc. In the Potteries, British felspar, sand and flint were substituted for the unobtainable foreign supplies.

The increased steel production (especially "basic" steel), necessitated by the war, led to big demands for basic linings for steel furnaces. In consequence of the cutting off of supplies of Austrian and Greek magnesite the home resources of dolomite have been largely drawn upon, with noteworthy success. A similar artificial impure product of dolomite, silica, iron oxide, etc., has been prepared in the American cement-kilns, and sold under trade names such as cinderlag, magdalite, etc.

For lining acid-open-hearth steel furnaces large quantities of high-silica sands were formerly imported from continental countries. These have now been replaced by eminently suitable British supplies from Leighton Buzzard, Lynn, Huttons Ambo (Yorks), and many other localities. The sand was of necessity required to be highly refractory to heat and yet to contain sufficient impurities (like compounds of alumina, lime, magnesia, etc.) and to be of such size of grain that it would just "frit" and bind together on the sides of the bath when the furnace bottom was being repaired. Sands of medium to coarse grade, containing 98 or 99 per cent. silica, with an almost entire absence of alkalis, proved to be most suitable.[7]

Very pure sands were also much in demand for the manufacture of the better-class types of glass-

[2] Vol. 1, Tungsten and Manganese Ores. Vol. 2, Barytes and Witherite. Vol. 3, Gypsum, Anhydrite, Celestine, etc. Vol. 4, Fluorspar. Vol. 5, Potash-felspar, Phosphate of Lime, etc. Vol. 6, Ganister and Silica-rock, Dolomite. Vol. 7, Jet, Cannel, Lignite, etc.

[3] Report of the Department for the Development of Mineral Resources, 1918, and other publications mentioned below. Hatch: Average Analyses of British Iron Ores and Ironstones, 1918.

[4] Iron Ores. G. C. Lloyd. 1918.

[5] The World Supply of Potash. Bull. Imp. Inst. 1916. Titanium Ores. Ibid., 1917. Zinc Ores. Ibid, 1918.

[6] See particularly A. Scott: Trans. Ceramic Soc. (This J., 1918, 217 R, 206 A, 695 A.) Wilson, J.: Soc. Glass Techn. Vol. II. (1918), p. 177.

(7) A Memoir on British Resources of Refractory Sands, published at the Instruction of the Ministry of Munitions. London: Taylor and Francis. 1918.

ware. These too were formerly imported from France, Holland and Belgium. In order that as little of the "decolorised" as possible may be used, all glass-making materials, particularly raw substances like felspar and sand, should be as free from iron as possible. The silica percentage of good glass sands is usually 98 or 99, alkalis and alkaline earths are not harmful, but iron, estimated as ferric oxide, should not, for lighting glass and pressed ware, exceed 0·08 per cent., and for optical glass 0·02 per cent. The presence of alumina is an advantage in glasses where toughness and absence from devitrification are required.[6]

But perhaps the most difficult, as well as the most interesting, problems were those concerned with the use of sands for founding metals and alloys, particularly steel. Sands of very special character and behaviour were formerly imported from France and Belgium. The examination and analysis of these sands led to the exploitation of many British supplies. A high-class steel-moulding sand should be refractory to heat, and therefore must contain a minimum quantity of alkalis and alkaline earths and a maximum of silica. It must also "strip" freely from the castings made in it, and therefore should contain a moderate quantity of hydrated ferric oxide. It should possess a good "bond" in order that it may stand up against the molten metal; the bond is usually a mixture of clay-like and micaceous material, together with hydrated ferric oxide, and is colloidal in character. By virtue of the last constituent the sands are able to take up a good proportion of water without becoming really wet, and after dehydration by the hot metal poured into the mould can be readily hydrated again.

New lines of inquiry are opened up by the consideration of the production synthetically of moulding sands from an admixture of a high-silica sand and small quantities of fireclay and colloidal hydroxides like those of aluminium, iron, or even cerium and zirconium, since the compounds of the two last-named elements would be required only in very small amounts.

Further, it is found that the texture of moulding-sands is of considerable importance. The mechanical composition is characterised by the high proportion of coarse and medium sand grades (diameter of grains greater than 0·25 mm.), the low proportion, or absence of the fine sand and silt grades (0·25 mm. to 0·01 mm.), and the relatively high proportion of the clay grade (less than 0·01 mm.). Chemical analyses of these various grades, which have been separated by elutriation, yield results of much value in steel-founding practice.

A danger exists that in consequence of the cheapness of foreign supplies of raw mineral materials, and of the lowness of the through freight rates from adjacent continental countries, it may be impossible to continue to work British supplies of these materials. It was the energetic exploitation of these mineral resources, so essential for key industries, which saved the situation time after time during the war. A renewal of dependance upon foreign resources is not only grossly unfair to those who have laid down plant and sunk their capital in British mineral enterprises during the last four years, but is a source of grave national danger, inasmuch as it places the country in precisely the same position as that which arose during the early months of the war.

If it is not possible to impose restrictions on the importation of certain foreign raw materials, recourse must be had to the revision of railway freights and the rapid development of internal water transport.

(6) A Memoir on British Resources of Sands and Rocks used in Glass-making. Published at the Instruction of the Ministry of Munitions. London: Longmans, Green and Co. 1918. 2nd edition.

THE BRITISH EXPLOSIVES INDUSTRY AND THE WAR.

The information contained in this article has been compiled from authoritative sources and with the object of showing the development of the explosives industry during the war in so far as chemistry played a direct part in it. The material dealt with has been restricted solely to explosives; and, in consequence, reference to gas manufacture and similar industries allied to the work of the Explosives Department of the Ministry of Munitions has been omitted. The subject has been divided into the following sections:—1. The position of the explosives industry in regard to chemistry immediately prior to the outbreak of war. 2. The development of the industry in regard to chemistry during the war, chemistry being used in its broader sense to cover academic work, research work, and manufacturing work. Each of these has been treated roughly according to the following sub-divisions:—

(a) Nature and quantity of the explosives made in this country for military, naval, and commercial purposes.

(b) Raw materials used.

(c) Processes followed.

(d) Quality of the products, with their cost of production, introducing process control, efficiency, and costing.

(1) Pre-War Position of Explosives Industry.

(a) The publications of the War Office and of the Admiralty give in detail the explosives made and the uses for which they are required. High explosives for bursting charges of shells, for mines, grenades, bombs, etc., consisted chiefly of picric acid or TNT. These two explosives were manufactured in quantities not greater than fifty tons per week. The Government had not adopted to any extent the use of TNT as its shell charge, and that which was made was purified by recrystallisation. The propellant in use by the British Government was cordite, consisting of 30 per cent. nitroglycerin and 65 per cent. of nitrocotton, gelatinised with acetone and stabilised with mineral jelly. The production of this explosive throughout the country did not exceed 50—100 tons per week, including that made for cannon and for rifle ammunition. The manufacture of mines, fuses, detonators, primers, etc., covered the manufacture of small quantities of guncotton, gunpowders, mercury fulminate, tetryl, etc., although this last substance was not used to any extent. Commercial explosives made in this country probably amounted to some 300 tons per week, and included standard gelatin explosives, permitted explosives for coal-mining, with dynamite and various blasting powders. In addition to these trade explosives a variety of sporting powders was made by the various explosives companies.

For the production of the quantities required by the Government a certain proportion was made at the Government factories, Waltham Abbey and Woolwich Arsenal. With these two exceptions the whole of the industry indicated above was in the hands of private companies, and a very large proportion of the production was exported.

(b) The raw materials required and used by the explosives industry consisted mainly of sodium nitrate and iron pyrites for acids manufacture, together with phenol for picric acid, toluol for TNT, cotton cellulose for nitrocottons, glycerin for nitroglycerin, mineral jelly and acetone with nitrocotton and nitroglycerin for cordite, charcoal with potassium nitrate and sulphur for gunpowders, dimethylaniline for tetryl, etc. These covered the chief raw

materials used in making explosives for ammunition. For commercial explosives a variety of raw materials was used in addition to those for nitroglycerin and nitrocotton, which included generally potassium nitrate and perchlorate, ammonium nitrate, woodmeal, potassium chloride, ammonium oxalate, barium nitrate, etc. In the majority of these cases the raw materials were purchased by explosives manufacturers and did not form part of the industry. One intermediate industry which was undertaken by explosives manufacturers was, of course, the production of acids, oleum, sulphuric and nitric, and mention is made of this as during the war the acids industry as a whole was largely concerned with the production of explosives.

(c) It is necessary to preface remarks upon processes by drawing attention to the dangers of manufacture and the numerous safety precautions which had to be taken, and which caused the explosives industry to become a special section of the chemical industry. With regard to the processes, picric acid was prepared entirely from phenol, and TNT was prepared in three stages through mononitrotoluol and dinitrotoluol, the crude trinitrated product being purified by recrystallisation from benzol. Methods of manufacture of nitroglycerin and nitrocottons did not undergo any essential changes during the war, and are already well known from literature. In the manufacture of cordite the acetone used as a solvent was only recovered, either by water or sodium bisulphite, to the extent of not more than 20 per cent. of the quantity used. The manufacture of explosives for fuses, detonators, primers, etc., for sporting powders and for blasting explosives was in the majority of cases well established and well known.

(d) Apart from the control exercised by manufacturers themselves, supplies to the Government were made according to a specification and governmental inspection. In specifications for the finished product were included also specifications for the raw materials and for semi-manufactures. The manufacture of all explosives was subject to the licence of the Explosives Department of the Home Office. The processes of manufacture were carefully supervised by chemists to ensure the necessary quality and properties of the finished materials, and also to ensure as far as possible the safety of the operations. Except possibly in individual cases little attention was paid to the cost of manufacture by the chemists, and generally it may be said that no organised scientific study of this important item of manufacture fell to the lot of the chemists in control of operations in factories. In the explosives industry—leaving out acids manufacture—by-products or waste products were negligible items.

Generally, explosives manufacture in this country from the point of view of chemistry was in a somewhat crystallised state, and the chief work of the chemists lay in:—1. A careful study of the factors influencing the quality and stability of all the explosives made. This was undertaken by the Government, by the Research Department at Woolwich, and in the public interest by the Explosives Department of the Home Office. Manufacturers had also, of course, equally to study the problem. 2. Research work consisted mainly of the study of the theory of explosives, the relatively slow development in the establishment of new products to meet demands, and to some extent research on methods of manufacture, examination of patents, etc. Technology had comparatively little controlling voice in the explosives industry, although the latter from its nature necessitated the employment of considerable numbers of qualified chemists.

(2) Development during the War.

With the outbreak of war it was obvious that considerably increased supplies of explosives would be required, although the amount of the increase was not at once known. The country's chemical industry was badly equipped for the large increase necessary, especially in supplying some of the essential raw materials which formerly came from Germany, or which were imported from other sources. Production consequently was the paramount factor, and initially all attention was directed to obtaining the greatest output possible under the new conditions. Explosives, the properties, uses and methods of manufacture of which were already known, had to be used. The question of output became a question for the chemists themselves to study, so that the utmost capacities of their plants, with possible alterations in the methods of manufacture to increase production, were utilised. The control of supplies for military purposes was retained under Lord Moulton at the War Office until the new Ministry of Munitions was formed, when a separate Department of Explosives Supply was instituted. Meanwhile the decision to erect, amongst others, National Explosives Producing Factories, was taken. The lack of the necessary accurate technical knowledge and data and technically trained men then became apparent.

(a) An output of picric acid was provided for during the war of approximately 1000 tons per week. TNT was eventually adopted by the Government, and its output was provided for in similar proportions, of which some 500 tons per week underwent purification by recrystallisation. The capacity for propellant manufacture in this country was eventually increased to some 2500 tons per week. The subsidiary manufactures, explosives for mines, fuses, detonators, primers, etc., were increased proportionately.

In view of the magnitude of these extensions, various causes—for example, raw materials shortage—curtailed the production of commercial explosives for blasting and sporting purposes. The latter manufacture was stopped, but although export of blasting explosives was also stopped, except to our colonies, it was essential that production of a limited quantity for coal mining and other purposes necessary to the war should be maintained. Modifications in the composition of the explosives made were necessary, of which the chief were the substitution of potassium nitrate by sodium nitrate, involving special precautions of manufacture owing to the hygroscopicity of the latter, the reduction in the use of nitroglycerin to conserve glycerol supplies, the adoption of new safety ingredients owing to the stoppage of supply of potassium chloride, ammonium oxalate, etc.

The capacity of production, as finally obtained throughout the country, was divided between (1) Government factories operated directly by the Government; (2) Government factories operated by private explosives firms, as agents for the Government; (3) private manufacture considerably assisted in capital by the Government.

After a period the output from the capacity provided had reached such dimensions that it was possible to devote a portion of the time otherwise given to questions of output to methods of manufacture and costs of production, and at the same time the importation of finished explosives from the United States was much curtailed.

(b) The supply of the raw materials required the closest attention from the outset, and called for increasingly greater attention as the war went on, owing to shipping difficulties. This necessitated the control, by those responsible for the supply of explosives, of other industries besides the explosives industry, and necessitated the development to the utmost extent of the sources of supply in this country and the development of new sources and processes of manufacture.

The raw material for nitric acid continued to be sodium nitrate, although during the latter stages of the war the atmospheric nitrogen processes were

receiving very close attention. The sulphuric acid industry used, in addition to pyrites, both sulphur and zinc blende as its raw materials. For picric acid manufacture some 400 tons of phenol were required, of which two factories successfully contributed to it from phenol synthesised from benzene, employing different methods Benzene was also employed directly for picric acid manufacture by way of dinitrophenol from dinitrochlorbenzene. A further demand by the explosives industry on the coal distillation industry was in the requirements of toluol, which amounted to some 500 to 600 tons per week, and in the demand for ammonia for ammonium nitrate. An additional source of supply of toluol was developed by the Asiatic Petroleum Company from Borneo spirit.

The adoption of amatol as the standard charge for high explosive shells required the production of some 3000 tons of ammonium nitrate per week. This product was manufactured by three processes—

(1) From sodium nitrate and calcium chloride, giving calcium nitrate, which was then made to react with ammonium sulphate;

(2) By the ammonia soda process;

(3) Directly from ammonium sulphate and sodium nitrate.

The development of propellant manufacture necessitated the provision of the following quantities of raw materials:—

Refined glycerin.—To the extent of about 400 tons per week, for which the greatest possible production was obtained from the soap and fat splitting industries of this country, by improving existing processes to give better yields.

Cotton Cellulose.—To the extent of some 8/900 tons per week, involving the purification, the whole of which was carried out in this country, of some 1,300 tons per week of raw materials. With the introduction of R.D.B. cordite, Admiralty cordite, and nitrocellulose powder, this bulk production had to be divided into 500/600 tons of improved cotton cellulose for land service cordite, 160 tons per week of sliver (a specially selected and treated raw material), and towards the end of the war up to 100 tons per week of special cotton prepared from linters for nitrocellulose powder.

Acetone.—To the extent of 100/150 tons per week, the bulk of which was imported. Processes were, however, worked out and in operation at two factories for producing acetone by the bacteriological fermentation of maize meal. This process produced only relatively small quantities of acetone with butyl alcohol as a by-product, the uses found for which included the conversion to butyl acetate as a spirit for military cooking purposes, etc. The conversion of butyl alcohol to methyl ethyl ketone was also worked out and the process adopted in Canada, permission having been obtained to use this solvent as a substitute for acetone.

A small proportion of the acetone was also produced from acetate of lime when this was not required for the production of acetic acid. Acetate of lime was obtained from wood distillation, an industry which was considerably developed by the Government during the war.

Alcohol.—R.D.B. cordite and nitrocellulose powder necessitated the supply of some 800/1000 tons per week of alcohol, the whole of which came from distilleries, and of which 40 per cent. was converted into ether by plants erected during the war in this country.

Ammonium perchlorate was also required for certain products, and the manufacture of this was developed at one of the Government factories to the extent of 50 tons per week by electrolytic method from sodium chloride, and by another factory in Flint, following a slightly different method.

The necessary substitution of potassium nitrate by sodium nitrate has been referred to above.

(*c*) New processes for new products, and changes in processes either necessitated by circumstances or for improvement, are instanced generally by the more important examples given below.

In the nitration of phenol for picric acid processes were finally operated by which weak nitric acid and mixed acids were used instead of strong nitric acid, as originally employed. The process starting from benzol, involving the separate manufacture of dinitrophenol from dinitrochlorbenzol has already been mentioned.

The three stage process for the manufacture of TNT, using oleum in the final nitration stage, was replaced by the two-stage process, using mixed acid, and the proper treatment of the waste acids was thoroughly established. By this change the consumption of acids was considerably reduced, although the production of TNT in the United States was carried out by the three-stage process in which the consumption of acids was even less than that obtaining finally in this country. Mention must also be made of the continuous process of manufacture of TNT from mononitrotoluol, which was followed finally on a large scale by one factory. The purification of TNT was originally carried out by recrystallisation from benzol. The necessity for continuing this purification, which during the war resulted in three large explosions, was carefully investigated. The quantity of purified TNT required was obtained by hot or cold washing the crude TNT with methylated spirit, depending on the form in which the crude product was received for purification. In addition to this change, a method was finally worked out, although not put into operation, by which washing could be effected by hot water in a centrifugal machine.

The charges for shells, bombs, grenades, smoke and incendiary powders, etc., underwent considerable changes, the most important of which was the replacement of picric acid, the cost of manufacture of which was some £200 per ton, by, first, TNT alone, and later by TNT mixed with ammonium nitrate. The composition of these latter mixtures changed from 60 parts TNT with 40 parts ammonium nitrate to 20 parts TNT with 80 parts ammonium nitrate. The last composition permitted of relatively simple manufacture and control, and the cost of TNT and ammonium nitrate in the 20/80 amatol worked out at £60—£65 per ton. This explosive was adopted in America as the standard for the U.S. high explosive shells.

Propellants in this country, the production of which actually reached some 2,000 tons per week, underwent considerable changes. The shortage of supply of acetone which was used for standard prewar cordite, necessitated from 70—80 per cent. of the total production being made with ether-alcohol as solvent. This change required the use of a different notrocotton and a new composition. The product may be regarded as a new powder involving the complete re-study of the processes of manufacture. A large number of practical difficulties was successfully overcome. Apart from the improvements resulting from experience in manufacture, a study of the factors affecting the ultimate consumption of the solvents, acetone, ether, and alcohol, became urgently necessary. This study required considerable research on cellulose and the effect of its properties on solvent consumption and on new methods of recovery. As a result, approximately 35—40 per cent. of the acetone wasted in the early days of the war was recovered. In the manufacture of R.D.B. cordite the attention given to the question of solvent consumption had resulted, in those factories in which the necessary plant had been completely installed, in a recovery of 35—40 per cent. of the ether and 65 per cent. of the alcohol used. By the method of recovery finally adopted the vapours given off during the drying operations were absorbed in cresol, the demand for which, of course, had also to be met.

In addition to the manufacture of this type of cordite a factory was erected, and was in operation during the latter months of the war, although it had not reached its nominal output, for the manufacture of nitrocellulose powder, the standard powder of the United States.

Fuses, detonators, primers, etc., mainly underwent the development required by the considerable use during the war of the high-explosive shell. This necessitated the careful study of and research on the methods of initiation and detonation, either by percussion or time fuses, or both. The chief development was the combination of the pre-war detonating agent, fulminate of mercury, with tetryl as primer. Otherwise, in this section of the industry, little development has to be recorded in the raw materials used and in the processes followed. A considerable amount of research was, of course, necessary on the properties of the explosives themselves, their sensitiveness, means of initiation, the reason for faulty initiation or detonation, *e.g.*, prematures; effects of explosion by measurements of power and velocity of detonation, etc.

(*d*) The huge cost of the explosives during the war and the necessity for conservation of the raw materials from all points of view involved the closest study of efficiency both by the Government and by private manufacturers—using the term efficiency in its broadest sense. As a result of the closest attention to all details—work which fell very considerably to the chemists in the explosives industry—the costs of manufacture were very substantially reduced. The extent of this has been indicated by certain figures given above. The details of the effect of the application of efficiency to the explosives industry are already included in publications issued by the Department of Explosives Supply. Reference is also made to the special researches and the application of the results as regards the safety of manufacture and stability of the explosives. All accidents, however small, were investigated by a special committee of the Ministry of Munitions, and steps were taken to educate those engaged in the manufacture of explosives for the first time during the war to the attendant dangers. Instances of the results of the work done are:—

(1) The inclusion of TNT as a recognised explosive under the Explosives Act, without to any serious extent affecting production. This was only done after exhaustive research on the properties of TNT and the impurities contained in it.

(2) The study of solvent vapour explosions in the manufacture of propellant powders, from which results of scientific interest and practical value to other industries besides the explosives industry were obtained.

The high standard of stability insisted on by the Government before the war was to a very large extent maintained throughout the war period, and although no direct improvements were made in old-established manufactures, researches conducted in this section of the work led to the use of the highest quality raw materials, and purification processes, by which the stability of the products was ensured to the greatest possible extent.

On the signing of the armistice explosives manufacture for war purposes was immediately stopped. Picric acid, TNT, propellants, tetryl, and in a large number of cases the industries supplying the raw materials, completely ceased manufacture within a few weeks. With regard to commercial explosives efforts are now being made to regain the position held before the war. The stoppage of manufacture released considerable numbers of trained chemists for general industrial purposes.

The above remarks give a broad indication of the results which the work of chemistry in all its branches achieved in the explosives industry during the war. These results shew that the spirit of initiative and the research work done by chemists in this country are at least equal to those of other countries; they demonstrate the value of the organised application of chemical technology to production; and they should assist manufacturers and consumers, as well as chemists themselves, to realise the material advantages to be obtained.

THE MANUFACTURE OF SULPHURIC ACID BY THE GRILLO PROCESS.

RAYMOND CURTIS.

Since the Ministry of Munitions erected Grillo plants to produce the necessary sulphur-trioxide for explosives manufacture, reference to this type of plant is frequently made in the scientific literature. But no short account summarising the main features of the Grillo—particularly of the Government or Quinan type—its efficiency and production costs, has yet appeared; it is hoped that the following brief notes will help to meet this want.

Prior to the war the Grillo oleum plant was but little known in this country, although it was generally regarded in the States as the most efficient of the contact plants. The first of the Government Grillo plants—designed under the direction of Mr. K. B. Quinan—was ready for production in the summer of 1916, and altogether 25 such units (each capable of an output of 25—30 tons sulphur trioxide per day) were erected by the Department of Explosives Supply.

All contact plants are concerned with the same problems, namely, the production of sulphur dioxide, the purification of the burner gases, the conversion of the dioxide into the trioxide, and the absorption of the last named. The only essential difference between any of the contact systems is the method and apparatus used for converting the dioxide to the trioxide. In the Grillo plant the catalyst is platinum on granules of calcined magnesium sulphate.

All the Government Grillo plants consumed sulphur during the war, and had the ordinary type of hand-fed tray burner; but of course any type of burner for any of the sulphur ores can be used. Thus at Avonmouth the Delplace burner for zinc blende is being connected up.

In the purification of the burner gases the following system is employed:—

(*a*) Cooling the burner gases to atmospheric temperature in lead coolers;
(*b*) next, filtering the gases through 24 feet of graded coke at a velocity of about 0·2 feet per second;
(*c*) passing the gases through three sulphuric acid drying towers;
(*d*) and a final filtering through 16 feet of graded coke.

For the conversion of dioxide to trioxide the gases entering the platinum converter require to be at a temperature of 350° C. or thereabouts, and in the Grillo plant the necessary heating of the burner gases after purification is done by heat exchange—from the gases leaving the converter and from the hot burner gases. No fuel need be consumed for preheating. For an output of 25 tons of sulphur trioxide per day, the gases are passed in parallel through two converters each containing 10,000 lb. of mass with 0·3% of platinum. The mass in each converter is equally distributed on four trays, and a careful temperature control of each layer (say, 380°, 470°, 460°, 440° C. on the 1st, 2nd, 3rd

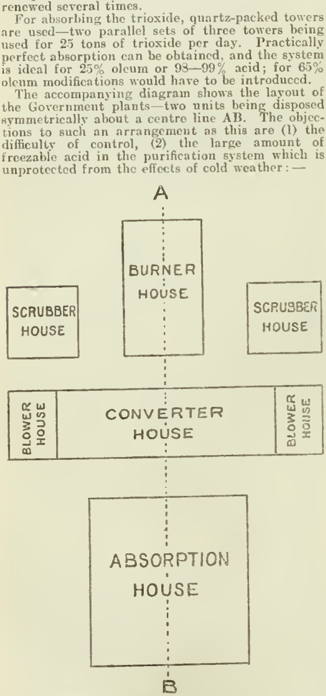
and 4th layers respectively) allows of a 96—97% conversion.

One great advantage of this type of converter is the relative ease with which the mass can be prepared (calcined magnesium sulphate sprayed with a solution of platinum chloride). The converters are packed without difficulty, and it is said that the mass is easily regenerated or a good recovery of platinum obtained should this at any time be necessary.

With correct temperature control the "life" of one of these converters is entirely dependent on the efficiency of the purification system. In the Government Grillo plants the gases entering the converter contained less than 0·02% of impurity (water, and inert dust), and arsenic was of course absent. Except in one or two of the early units, which were very much overloaded, there is at present no indication that any of the mass has deteriorated, but in a privately owned plant where the purification system was quite inadequate for pyrites the mass has been renewed several times.

For absorbing the trioxide, quartz-packed towers are used—two parallel sets of three towers being used for 25 tons of trioxide per day. Practically perfect absorption can be obtained, and the system is ideal for 25% oleum or 98—99% acid; for 65% oleum modifications would have to be introduced.

The accompanying diagram shows the layout of the Government plants—two units being disposed symmetrically about a centre line AB. The objections to such an arrangement as this are (1) the difficulty of control, (2) the large amount of freezable acid in the purification system which is unprotected from the effects of cold weather:—



In the Mannheim and Tentelew plants the whole unit is under one roof, and there is of course no reason why this should not be done in the case of the Grillo plant. The arrangement shown, however, tends to the greater cleanliness of the plant.

Efficiency of the Grillo plant.

Exhaustive tests on the efficiency of these plants (*i.e.*, the percentage recovery of sulphur in the form of acid from the sulphur consumed) were made at each of the Government factories. The following figures are typical:—

Overall efficiency	94·5%
Recovered in absorption system ...	91·5%
Recovered in purification system (from trioxide produced in the burners)	3·0%

A careful analysis was made of the losses and the following figures are again typical:—

Unconverted SO_2	4.2% (of total sulphur charged to plant)
Unabsorbed SO_3 and acid spray	0·6%
Dissolved SO_2 in drying acid.	0·3%
Gas leakages and losses, etc.	0·4%
Total loss	5·5

Cost of production.

At the present time no reliable figures for capital outlay for the erection of a Grillo plant could be given, but two years ago it was computed that a unit to produce 25 tons trioxide per day would cost £55,000 (a chamber plant of similar capacity costing £70,000), and this is the figure taken in the following estimate of the cost of production of 1 ton trioxide*:—

	s.	d.
Amortisation	12	6
Labour	6	9
Power and water	3	6
Maintenance	1	0
Rents, taxes, etc.	6	3
Total	£1 10	0

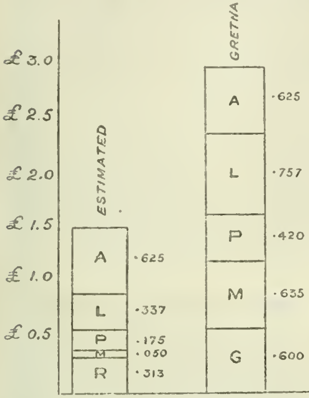
So that according to these figures the cost of 1 ton of trioxide would be the cost of the raw material plus £1·5. If the estimate be compared with the actual costs in any of the English factories it will be found that it is very considerably less than those obtained. In Part II. of "Cost Analysis in Chemical Manufacture" (J., 1918, 225 R), the service charges per ton of trioxide for the Gretna Grillo plant are given as £2·412 (Jan.—June, 1918), and this figure does not include any charge for depreciation. Although these service charges were slightly improved upon at the Avonmouth factory (see chart opposite p. 226 R), this figure may be considered as representing English practice during the war. The accompanying diagram will enable a comparison to be made at a glance between the estimated and the Gretna costs.

The question naturally arises as to whether the English cost is to be considered abnormally high or whether the estimate is much too optimistic. The difference between the two is very largely explained by (1) the high "general" charges in Government factories, (2) higher labour costs, and (3) higher maintenance costs. In privately managed factories the first item could be decreased very considerably; with regard to labour, the experience at Avonmouth showed that the previous Grillo practice in this respect had been too expensive, and that with careful training of unskilled labour the estimated cost (£0·337 per ton trioxide) is not unreasonable. The actual figure at Avonmouth was £0·560, but

* Taken from "Notes on Sulphuric Acid Manufacture" issued by Department of Explosives Supply, 1917.

the plant was really staffed for an output of twice that actually obtained, so that this figure should be approximately halved to get a true labour cost.

The question of maintenance charges has been a very "thorny" one. A glance at the chart previously referred to will show that the Avonmouth



A. Amortisation; L. Labour; P. Power, water, fuel; M. Maintenance; R. Rent, taxes, etc.; G. 'General' charges;

factory was the only one where the figure approximates to that of the estimate (£0·138 as against £0·05). The latter was based on the cost for a South African plant which had been running for a considerable number of years, and, on the face of it, there seems no reason why the upkeep of a British plant should be higher than that of a South African plant. It is mentioned in the Report on Cost Analysis (this J., 1919, 225 R) that the maintenance charges on the Government plants have shown a downward tendency. Undoubtedly this is partly due to the greater experience of the staffs, but also—and mainly—to improvements in the plants themselves with the elimination of the inefficient and less durable features. The cost of changes thus brought about (*i.e.*, perfecting new plant) appears as maintenance charges, and for this reason these charges for all the new Government plants are in excess of those necessary for a well-established plant. This largely accounts for the high Grillo maintenance charges, and will partly explain why the Avonmouth plant, which was built with the Queen's Ferry and Gretna experience to go upon, was so much more economical.

Taking the above points into consideration one would anticipate a considerable reduction in the service charge of £2·4 per ton trioxide in any thoroughly established, well-run Grillo plant.

In the Government factories it was found that the cost of trioxide production in the Grillo plants was considerably less than in any of the Mannheim plants or in a well-run Tentelew (see chart p. 226 R for details). Unfortunately there was not a chamber plant run by the Explosives Department, so that no very reliable figures are available for comparing the cost of production in this plant and in the Grillo. In the paper on Sulphuric Acid Manufacture already referred to the cost of manufacture of 1 ton trioxide from pyrites in the form of chamber acid is estimated at £3·562, while the cost of manufacture in the Grillo is given as £3·190. The suggestion is there made that sulphuric acid *of any strength* can be most cheaply made by the Grillo type of plant. However, many manufacturers who have had experience with both types of plant are of the opinion that where weak acid is being obtained from a dirty one the chamber plant will produce acid most economically; and this view is evidently widely held in America too, where the chamber plant is in nearly all cases used for ores (*e.g.*, of copper) which give very impure burner gases. With this exception the experience of the past two or three years seems to indicate that sulphuric acid can be most efficiently and economically produced by the Grillo type of plant.

THE STREATFEILD MEMORIAL LECTURE.

The second annual lecture was delivered on October 2 at the Finsbury Technical College by Professor G. T. Morgan, the retiring professor of chemistry at the College. Dr. M. O. Forster, who presided, announced that the Streatfeild Memorial Prize for practical chemistry had been awarded to Mr. F. D. M. Hocking, and that the Committee of the College had instituted a Streatfeild Memorial Medal to be presented to the lecturer for the year. The lecture was in the main devoted to the subject of "Applied Chemistry in Relation to University Training," but it was interspersed with numerous reflections of a general and topical nature and with appreciative references to the work and character of the late Mr. F. W. Streatfeild (see this J., 1918, 412 R).

The social unrest which is now a feature of the times is largely the result of a disinclination to profit from the wisdom of the past and of failure to realise the vital significance of the Fifth Commandment. The scope of this injunction extends to educational bodies like the City and Guilds of London Institute, and to great teachers like Ayrton, Meldola, Sylvanus Thompson, Castelli-Evans and Streatfeild, all of whom are worthy of a lasting sense of gratitude. The utility of the institute has been manifested in two directions: to individuals it has offered the chance of a higher career, and to the State it has furnished trained men who were fully qualified to apply science to industry. Great Britain was the first nation to reach the industrial phase of human development, and owing to the absence of foreign competition its manufacturers were able at first to thrive on rule-of-thumb methods; but when foreign competitors, utilising scientific methods in their manufactures, entered the field, the demand arose for technical education. This need was first met by the Livery Companies of London, which combined to found the City and Guilds of London Institute, under whose auspices the Technical College, Finsbury, was established in 1878, and the Central Technical College, South Kensington, in 1884. The underlying idea that the chemical department of the former should serve as a training school for that of the latter was not fulfilled, the two departments developing on different lines. Under Professor Armstrong's inspiration chemistry at the "Central" acquired increasingly a biochemical bias, and also became widely known as the London centre for chemical crystallography; but this department was unfortunately closed in 1908. The Finsbury laboratories, on the other hand, worked more in the direction of coal tar dyes and intermediates, and with an equipment which became more and more out of date. In 1916—17, at the lecturer's instigation, extended accommo-

dation and new equipment were provided for the chemical department. These were utilised mainly for investigations connected with the war, and, among other successful achievements, a rotating autoclave was devised which has proved of great utility to many investigators engaged in similar work.

The far-sighted policy of the Salters' Company in spending the available funds of the Salters' Institute of Industrial Chemistry on brains and not on bricks and mortar has a bearing on the alternative policies of concentrating technical instruction in one colossal institution or of distributing it among a number of educational establishments of a less pretentious order. The "Super-dreadnought" theory is espoused by those who demand that the Imperial College of Science and Technology shall be accorded the full status of a university with power to grant degrees in technology; but this scheme overlooks the claims of older foundations which initiated and carried out this work for many years. The Royal College of Science and the Finsbury Technical College should be brought into harmonious co-operation within the fold of the same university, and each should retain its distinctive individuality. It is also important that students of applied science should be brought into close association with a general storehouse of learning and scholarship, and it must not be overlooked that no technical college can claim and maintain a monopoly of this branch of education; existing universities can and do take up similar lines of teaching in technology. So far as college training goes the line of demarcation between science and technology is ill-defined and ever-changing. Teachers who have been appointed to technical institutions on account of their acquaintance with industrial practice soon lose most of their expert knowledge unless they take special pains to remain in touch with the industries in which they previously specialised; and university teachers may become discoverers of processes having great commercial possibilities, and may thus be led to acquire considerable insight into manufacturing conditions. The difference between university and technical college becomes ultimately one of breadth of outlook, with the advantage on the side of the university. Overlapping is inevitable, but not to be deprecated. Fundamentally, there is no difference in principle between pure and applied chemistry; there is but one chemistry, and the great generalisations of the science must be assimilated by all students, whether they subsequently undertake researches of an academic character or investigate problems directly associated with industry.

The objection raised to the low standard of general education demanded of students entering technical institutes is fast losing its cogency; and special provisions have been made at the Finsbury College to secure a high standard of education among those entering upon its courses. Further, the department of applied chemistry in the College was the first to extend its course by adopting a three-year curriculum. At the Royal College of Science for Ireland the full course is extended over four years, thus allowing of a fuller study of electro-technology and of training in a biological science—*viz.*, bacteriology. The absence of any biological teaching is a weak point in the education of many chemical students, and they would also derive much benefit from an elementary course in petrology and mineralogy. A valuable feature of the Finsbury curriculum is the generous provision of time for applied mechanics, machine drawing and electrical engineering; also increased attention has been devoted to the study of processes like filtration, distillation, extraction, etc., under works conditions.

The establishment of Finsbury Technical College on a university basis, preferably under the University of London, is in every way desirable. If undertaken initially in a small way the expense would not be prohibitive, and the greater part of the necessary funds could be obtained from those who would benefit by the increased facilities. Several chemical firms in the London area, and in Sheffield and Manchester, have taken advantage of the new accommodation afforded by the chemical department by sending research chemists to follow special lines of investigation. Thanks to the fees paid by these firms, a large proportion of the outlay involved in establishing the new laboratories has been recovered, and this development is so promising financially that if profit were the only consideration it would pay to drop elementary teaching and to concentrate entirely on post-graduate investigations in industrial chemistry. But such a change would involve abandoning the ideal aimed at by Streatfeild—a combination of elementary teaching and specialised research. The best solution would be to dovetail these two activities, for the association under the same roof of young beginners and post-graduate research workers creates a chemical "atmosphere" and plays no small part in building up a living school of applied chemistry.

THE PLATINUM SITUATION.

In an article in the *Engineering and Mining Journal* (July 26, 1919) Mr. J. M. Hill, of the United States Geological Survey, describes the uses, sources, and modes of occurrence of platinum, gives particulars concerning the interests controlling the deposits and the refining industry, and forecasts the future of the platinum mines.

As is well known, the main sources of platinum are situated in Russia, Colombia, Canada, the United States, and Australia. Canada is placed third, because, although its output of placer platinum is small, comparatively large quantities of the metal (and palladium) are recovered from the nickel-copper ores of Sudbury, Ontario. The yield from this source could be greatly increased. Of the lesser known fields, a small output has been obtained for some years from the gold dredges working on the Irawady River, India, and from the tin dredges in the Dutch East Indies. Platinum, in what may prove to be commercial placer deposits, has been found in the Sierra Ronda, in southern Spain, about fifty miles north-west of the port of Malaga; the concentration of platinum is not high, and it is problematical whether extensive developments will be warranted. Unconfirmed reports have reached the U.S. Geological Survey of discoveries of platinum deposits in Westphalia, Germany, in southern Siberia, at various places in Mexico, and from several localities in Ecuador and Peru. Platinum is known to occur in some of the streams, as well as in certain of the gold deposits of the Minas Geraes districts of Brazil. In south-western Borneo platinum occurs in the gravels of streams rising in the Bobaris Mountains in the Tanath-Laut district.

The following represent typical analyses of the crude placer platinum found in the more important fields:—

Analyses of Crude Platinum.

	Pt.	Ir.	Rh.	Pd.	Io.*	Au.	Fe.	Cu.	Sand.
	%	%	%	%	%	%	%	%	%
Russia Iss. ..	80.10	1.38	0.30	0.30	4.47	0.09	7.68	0.63	—
" Taguil	76.16	2.68	0.54	0.27	1.50	—	14.72	3.39	—
Colombia ..	86.20	0.85	1.40	0.50	0.95	1.00	7.80	0.60	0.40
California ..	63.30	0.70	1.80	0.10	22.55	0.30	6.40	4.25	—
B. Columbia..	72.07	1.14	2.57	0.19	10.51	—	8.59	3.39	1.69
N.S. Wales ..	75.90	1.30	1.30	tr.	9.30	—	10.15	0.41	1.22

*Osmiridium.

Prior to the war the French Compagnie Internationale du Platine practically dominated the Russian platinum industry by virtue of its mine holdings and purchasing contracts, but several large Russian companies were known to be more or less independent, as also were many small producers. The more important Russian producing companies included those of Shouvaloff, Demidoff, the Nicolo-Pavdinski Co., and the Platina Co. Although dredges were used before the war it was estimated that 80 per cent. of the output was obtained by the hand labour of lessees, who contracted to dispose of their output to the companies owning the ground and to pay a royalty. Since the war the peasants and miners have been virtually in control of all the mines, the original operators having but little to do with the management. Reports indicate that none of the dredges is in operation and but little platinum has been produced since 1914, any accumulated stocks in the country having probably been exported. The Colombian platinum alluvials have been controlled largely by American interests, but late in 1917 a British company was organised to work deposits in the Opogodo River, on the Upper San Juan. In British Columbia a large portion of the platinum placers in the Tulameen district is stated to be controlled by American capital, although Canadian firms are said to have large holdings on the Peace River in the northern part of the Province. An American company has recently been formed to exploit certain areas in the Barkersville region. The Ontario nickel deposits, which have considerable potential value as platinum and palladium producers, are operated by the Mond Nickel Co. and the International Nickel Co.

Platinum refining in the past has been in the hands of a few firms. A large proportion of the Russian output, although sold to a French company, has been treated by Messrs. Johnson, Matthey and Co., Ltd., of London. About 70 per cent. of the Russian output, half of the Colombian, and all the Australian and Indian was sent to Great Britain before the war, but it would appear that all was not refined here, as considerable quantities of crude platinum were exported to the United States. According to Russian statistics, about 25 per cent. of the Russian output was refined in Germany. In France the chief refiners include Quenessen, de Belmont, Legende et Cie, and the Compagnie Internationale du Platine. The United States platinum refiners include Baker and Co., the American Platinum Works, Irvington Smelting and Refining Co., J. Bishop and Co., and several others.

In regard to the future, there is no doubt that many of the Russian platinum deposits are still very valuable, and it seems very probable that the French Compagnie Internationale du Platine will make strenuous efforts to reopen its mines and renew the contracts with other Russian producers. It has been stated that probably it would not be difficult for American capital to obtain control of some of the more important mines, notably the Shouvaloff and Demidoff, and also to secure the output of other mines. English capital, however, is in a stronger position to enter into the Russian platinum producing industry than heretofore. At present the Russian deposits are idle, and it will require much time and capital to re-establish the industry. The known Russian deposits are becoming exhausted, and according to Duparc, the reserves at present known have a life of twelve years at the pre-war rate of consumption.

Colombia appears to have large reserves of platinum-bearing ground, and probably further prospecting in the Choco districts would be well repaid. The Canadian deposits hold some promise for future developments, particularly those along the Rocky Mountains of British Columbia. Dredging for gold and platinum would appear to be feasible on the Willow and Peace Rivers, but the largest Canadian reserves are the Sudbury nickel deposits. A change from the present metallurgical practice will be necessary, however, in order to recover the maximum quantities of platinum and palladium.

An increase in the United States output of platinum does not appear very probable, especially when the arrangements for refining the Sudbury ore in Canada are complete. The U.S. placer deposits carrying platinum are relatively small, many of those in Northern California and Oregon cannot be remuneratively worked, and few can be dredged. As the dredging field along the base of the Sierras becomes exhausted the United States output will decline unless new sources are located meanwhile. It seems probable, however, that the output from Alaska will increase, as new localities are being found each year.

Australia does not hold out much promise as regards future production. The Fifield deposits are apparently nearly exhausted, and the beach deposits of Queensland and New South Wales are of too low grade. Spain has certain undeveloped platinum deposits which have been but little explored, but it would appear from the published reports that they are neither large nor rich. It was announced in 1918 that works had been erected at Wenden in Germany for recovering platinum from a shale which yielded about 1 oz. of the metal per ton.

Discussion has taken place recently regarding the price of platinum, the trend of which indicates that the present price is several times the value of the metal. The price for several years to come will probably not fall to the pre-war level of \$45 (£9) per oz., but will rather be nearer \$75 (£15). (See also this J., 1918, 338 R.)

"KEY INDUSTRIES" IN AMERICA.

A series of reports has been issued by the United States Tariff Commission detailing the recent development of various "key industries"—optical glass, chemical glassware, potash and its compounds, dyes and related coal-tar products.

Optical Glass.—In 1913 the United States imported optical glass to the value of \$506,594, and in 1914 to the value of \$617,703, of which one-half was imported from Germany and 27 per cent. from Great Britain. The home production of optical glass was commenced in 1917; the output in April of that year was 28,157 lb., and by October had reached 95,563 lb. The home production of optical glass is by no means sufficient to cover the demand, and even in 1918 about half the pre-war consumption had to be imported. A process has been devised enabling the manufacture of this glass in the pots to be completed in 24 hours, a saving of 12 hours on the old method.

Chemical Glassware.—Prior to 1915 practically all the chemical glassware used in America was imported. In 1913 the imports were valued at between \$1,200,000 and \$1,500,000. By 1918 the home production had increased to \$2,865,774 worth. No factories are engaged exclusively in producing chemical hollow glassware. During the latter half of 1917 the United States exported chemical glassware for the first time in its history. Chemical glassware is imported duty-free if employed for educational purposes, but a 45 per cent. *ad valorem* duty is levied on glass when used for manufacturing and commercial purposes. The withdrawal of the preference in the former case is being urged by manufacturers.

Potash.—The development of the United States potash industry has been previously referred to

(this J., 1918, 12 R, 135 R, 264 R, 1919, 248 R). The following returns show the various sources whence potash was derived during 1918:—

Source.	Number of producers.	Total production.	Available potash (K_2O).
		Tons.	Tons.
Natural brines ..	21	147,125	39,255
Alunite	4	6,673	2,619
Dust from cement mills	9	11,739	1,429
Kelp	6	14,456	4,292
Molasses distillery waste	4	9,505	3,322
Steffens waste water ..	5	2,818	761
Wood ashes	26	609	365
Other sources ..	3	262	92
	78	192,587	52,135

Potosh produced classified according to product marketed.

Product marketed.	Total production.	Variation in content of K_2O	Average content of K_2O.	Available (K_2O).
	Tons.	Per cent.	Per cent.	Tons.
Muriate	30,127	38.0–58.5	41.8	12,614
Low-grade chloride ..	6,559	10.0–20.0	13.6	894
Sulphate	6,672	25.0–51.0	47.9	3,188
Crude sulphate and carbonate	122,741	18.0–38.0	25.5	31,311
Crude carbonate and caustic	609	50.0–78.0	60.0	365
Potash char, ash, and ground kelp ..	14,630	12.0–42.5	19.8	2,896
Cement and blast furnace dust, alum, raw and calcined alunite	11,249	2.5–13.0	7.7	807
	192,587	—	—	52,135

Dyes.—Benzol, toluol, and naphthalene are manufactured in the United States in quantities far in excess of the demands of the dye and related industries. With anthracene the situation as yet is not so favourable. It is present in coal tar derived from American coals only to the extent of about 0·3 per cent., and its recovery is difficult of achievement. Certain technical difficulties have still to be surmounted before home supplies of anthracene will be available in adequate quantity and at a sufficiently cheap price. The supremacy of Germany in the supply and price of caustic potash and of ethyl alcohol will probably be offset by the large supplies of methyl alcohol and acetic acid derivable from the wood distillation industry of America, so that it is anticipated that, so far as concerns essential raw materials of the dye industry, no nation will be able to claim a permanent significant advantage over the United States. The subjoined table gives the production of various crudes, intermediates, and finished products during 1918. Group I. is free of duty, Group II. is dutiable at 15 per cent. and 2½ cents per pound, Group III. is dutiable in part at 30 per cent. and in part at 30 per cent. and 5 cents per pound.

	Number of manufacturers.	Quantity (pounds).	Value. (dollars).
Group I.—Crudes, free ..	35	—	22,474,075
Group II. Intermediates, dutiable	127	354,808,315	123,817,966
Group III.—Finished products	—	75,491,113	82,095,404
Dyes:			
Dutiable at 30 per cent. plus 5 cents per pound	—	52,517,235	57,535,934
Dutiable at 30 per cent.	—	4,638,365	3,770,106
Total of dyes ..	77	57,155,600	61,306,040
Colour lakes, dutiable at 30 per cent. plus 5 cents per pound	20	9,590,537	5,020,023
Photographic chemicals, dutiable at 30 per cent. plus 5 cents per pound	6	316,740	823,915
Medicinals, dutiable at 30 per cent.	31	3,623,352	7,792,981
Flavours, dutiable at 30 per cent.	7	458 256	4,925,627
Synthetic phenolic resins, dutiable at 30 per cent. plus 5 cents per pound	5		2,642,120
Tanning materials (synthetic)	1	4,233,356	
Perfume materials ..	0	116,263	584,695

The exports of dyes and dyestuffs amounted to $16,921,888 during the fiscal year ending June 30, 1918. The imports in the fiscal year 1913–14 amounted to 45,840,866 lb. The statistics show that the output of dyes in 1918 exceeded that in 1917 by 45,977,246 lb., valued at $57,796,228. The American industry is especially strong in the production of azo-, sulphur-, and induline dyes. The output of azo-dyes during 1918 was 24,811,141 lb., valued at $31,915,556. The total output of sulphur dyes was 22,510,799 lb., valued at $10,216,905. In the group of induline dyes, Nigrosine was, prior to the war, regularly shipped to Germany. The manufacture of triphenylmethane, diphenylmethane, and diphenylnaphthyl dyes still requires considerable development. The output of synthetic indigo is increasing, amounting to 3,083,888 lb. in 1918, and the productive capacity in June, 1919, was substantially greater than the amount imported in 1914. The manufacture of indanthrene dyes has only just commenced, and the same remarks applies to the indigoids and alizarin derivatives. It is realised that the American dye industry has hitherto been developed one-sidedly and is not at present on a sound economic basis, but it is confidently anticipated that these deficiencies will be removed in the course of time.—(*Board of Trade J., Sept.* 25, 1919.)

MEETINGS OF OTHER SOCIETIES.

THE INSTITUTE OF METALS.

The Sheffield meeting of this Institute, held on September 24 and 25, was the first provincial meeting since the outbreak of the war, and the resumption was marked by an unusually large attendance and a keen interest in the proceedings. In addition to the reading of papers, the programme included many visits to works, as well as certain social functions. The number of papers presented made full discussion impossible, and many would-be speakers were disappointed, but it is to be hoped that the papers will receive fuller discussion before the issue of the Journal.

In a contribution dealing with the season cracking of metals, Dr. Hatfield and Capt. Thirkell put forward the view that highly cold-worked metals, which exhibit this defect, are stressed in the outer layers to such an extent that the normal breaking down point is approached, so that local relief of stress, such as may be produced by corrosion, may cause cracking. The authors refuse to accept the hypothesis of intercrystalline fracture due to prolonged stress as caused by flow of the intercrystalline cement, and a vigorous discussion took place on this question. The paper included measurements of internal stress by a simple and effective experimental method. Messrs. E. A. Smith and H. Turner gave a valuable account of the manufacture and properties of sterling silver, an alloy which has received comparatively little scientific attention. The improvement in properties due to the addition of cadmium was described, and the effect of oxygen in producing "fire-mark" was noticed. Liquidation or segregation is prominent in the casting of this alloy, the fact that it is silver which becomes concentrated at the centre, contrary to the indications of the equilibrium diagram, attracting special notice. The fact was

observed by Robert Austen. The printed paper contains a very full bibliography. Two papers were presented by Dr. Thompson, one describing the occurrence of graphite and of oxide in "nickel-silver" (nickel-brass or German silver), and the other (with Mr. Orme) giving an account of Britannia metal. This alloy contains copper as well as lead and antimony, and may be rendered distinctly harder by rapid cooling. Dr. Stead presented a description of the remarkable ternary alloys of tin, antimony and arsenic, which are characterised by the formation of a compound crystallising in segments of spheres. This type of crystal has no exact parallel in nature, and the effect of the addition of arsenic to the tin-antimony alloys, the crystallisation of which is quite normal, is very striking. Some notes on the structure and behaviour of a bearing metal with a tin base, by Miss Fry and Dr. Rosenhain, led to a discussion on the properties of bearing metals and their suitability for the high pressures found especially in modern marine practice.

Prof. Desch's second report on the solidification of metals dealt with the form of crystal grains and their relation to foam cells, a striking similarity of form being observed. The types of polyhedra occurring in foams were examined, and it was shown that the form indicated by the usual mathematical theory was of rare occurrence. It was not found possible to infer the form of crystal grains from the examination of their outlines in a cross section. In the second section of the report, experiments were described in which the difference of temperature in different parts of the convection cells in cooling liquids were measured. A good discussion followed, in which Dr. Benedicks and Dr. Zay Jeffries laid stress on grain growth as proceeding under the influence of surface forces, and Dr. Bengough showed some photo-micrographs of metals exhibiting two orders of cellular structure. Prof. Boswell presented a valuable survey of the moulding sands suitable for non-ferrous foundry work. Whilst these metals are cast at relatively low temperatures, they present special difficulties of their own owing to "burning-on" and other reactions between sand and metal. The paper included a survey of the geographical distribution of suitable sands. Prof. Turner and Mr. Cosmo Johns dealt in the discussion with the effect of viscosity and the degree of wetting of the mould by the metal. Mr. Leader communicated a paper of local interest on the history of the silver electroplating industry, some of the early incidents of which appear to have been hitherto obscure. The last paper on the list, a note by Dr. Zay Jeffries on the ageing of duralumin, had unfortunately to be taken as read. The explanation proposed by the author is briefly that the low mechanical cohesion of freshly quenched duralumin is due to the presence of the copper-aluminium compound in ultra-microscopic particles, probably often separate molecules, and the increase of cohesion on ageing is due to the agglomeration of these particles. Increase of size of the particles beyond a certain limit, as by prolonged ageing at 200° C., diminishes the cohesion.

Exhibitions of old Sheffield plate, and of the war work carried out by Sheffield firms, were held in connexion with the meeting, the exhibits of the steel and armament firms being particularly striking. The members were also greatly impressed by the enormous extension of some of the local works caused by the development of manufactures required for war purposes.

The Ceramic Society.—Owing to the railway strike, the autumn meeting to have been held at Stoke-on-Trent on October 8 and 9, has been postponed until the end of April, 1920. The spring meeting arranged for London, 1920, has therefore been cancelled.

PERSONALIA.

The death is announced of Mr. J. C. Umney on October 9 at the age of 51.

Dr. J. O. Arnold has resigned the posts of professor of metallurgy and dean of the faculty of metallurgy in the University of Sheffield, owing to ill-health.

Dr. Shipley, Master of Christ's College, Cambridge, has retired from the office of Vice-Chancellor of Cambridge University. The Rt. Hon. A. J. Balfour has been elected Chancellor in succession to the late Lord Rayleigh.

Dr. E. Hope, a research assistant on Professor W. H. Perkin's staff, has been elected fellow and tutor in chemistry at Magdalen College, Oxford.

Dr. R. H. A. Plimmer has been appointed Head of the Biochemical Department of the Craibstone Animal Nutrition Research Institute, which is connected with the University of Aberdeen and the North of Scotland College of Agriculture.

Dr. F. W. Skirrow, for the past four years assistant professor of chemistry at McGill University, Montreal, has resigned this position to take up the duties of chief chemist to the Shawinigan Laboratories, Ltd., the newly founded research organisation of the Shawinigan Water and Power Co., Shawinigan Falls, Quebec.

CORRESPONDENCE.

CHEMICAL COMPENDIA AND ABSTRACTS.

Sir,—I consider that the project of producing an inter-allied "Beilstein" an unwise one. Unless the German publication can be improved upon considerably, which seems improbable, we shall simply be imitating our enemies at the cost of a large amount of money and energy. Money is none too plentiful, but its expenditure would not be so serious as that of the time of innumerable chemists, who would simply be repeating mechanical work which was being done equally well already. A possible effect of issuing a rival publication would be that both would be rendered so expensive to the producers that production would cease. The Germans have shown eminent capability for the compiling of such a work, and it is far better that Englishmen should devote themselves to work in which they can show real skill, such as the writing of scientific and technical books. In the last few years we have been very active in this direction, and many books we have published are most excellent; far better than the corresponding German ones. If the Inter-Allied Chemical Federation can do anything to encourage the production of well-written and reliable books on the many branches of pure and applied chemistry, it will do more to show that chemistry is not mainly a German science than by imitating Beilstein. The writing of such books requires intense and prolonged labour and considerable skill, and the remuneration is but small.

A matter which the Federation might well take up is the United States copyright legislation, the effect of which is to deprive the already underpaid British author of half his royalty on the American sales and put the money into the pockets of the American booksellers. It is to be hoped that the Americans will admit to their copyright books of a scientific or technical character, even though they have not been printed in the States.—I am, Sir, etc., A. Marshall.

Naini Tal, India. Sept. 4, 1919.

NEWS AND NOTES.

CANADA.

Oil Refineries.—The growth of oil refineries in Canada during the last four years has been very rapid. Additions have been made to all the plants, and those located at Vancouver and Halifax have been greatly extended. The plant at Halifax is now being duplicated.

Gold in Northern Manitoba.—With the advent of the Hudson Bay Railway, a new area for prospecting has been opened up in Northern Manitoba. Geological formations are such as to warrant close investigation of the territory by mining companies. Already large quantities of copper ore have been shipped to Trail, B.C., and recent discoveries of gold a short distance from Le Pas have greatly stimulated the interest taken in this district.

Developments in Steel Production.—It has recently been announced that a new steel plant and rolling-mill, to employ 2,300 workmen, will be established in Toronto by Baldwin's Canadian Steel Corporation, Ltd., which will occupy the premises of the British Forgings, Ltd. British capital to the extent of $10,000,000 will be invested by the owners of Baldwins, Ltd., Swansea, Wales. This firm is represented in Canada by Mr. A. M. Russell, of Hugh Russell and Sons, Montreal. Construction work is now under way.

The Huron Steel Corporation, with a capital of $15,000,000, is to undertake the manufacture of steel specialities at Goderich, Ont. This town is well situated on Lake Huron, and it is expected that a new hydro-power line, furnishing 25,000 h.-p., from Niagara, will be erected. In general, the deepening of the canals from Lake Erie to Montreal is likely to advance greatly the development of Canadian enterprises on the Upper Lakes.

Meeting of the Industrial Commission.—During the week commencing September 15 a general conference was called by the Dominion Government at Ottawa for the purpose of discussing labour problems. This was the largest gathering of representatives of organised labour and industrial capital ever held in the Dominion. A distinctive feature of the gathering was the large representation from technical societies and engineering organisations.

Industrial Conditions in Mining Centres.—Following the settlement of the strike of the silver miners in Cobalt district, the general conditions in large mining centres are better than they have been at any period since the war.

In the large coal mining and smelting district of Sydney, Nova Scotia, lack of shipping facilities has hindered the Dominion Iron and Steel Co. and the Dominion Coal Co. from again undertaking to furnish the St. Lawrence River ports with the quantity of coal they formerly supplied. The employees of the steel company have asked the Dominion Government to investigate the operations of the company in their interests. It is felt that the company ceased operating a portion of its plant without giving the employees reasonable notice.

The Chicago Chemical Exposition.—Thirteen Canadian firms were represented at the Annual Exposition of Chemical Industries of the United States, held at Chicago from September 22 to 27. The interest taken by Canadians in this growing exposition is a matter of considerable importance from the standpoint of trade developments, since the United States offers an excellent market for Canadian chemical and metallurgical products.

The Toronto Fair.—Over 1,100,000 persons paid admission this year to the annual exhibition known as the Toronto Fair, in which many companies interested in fertilisers, cattle food, chemical machinery, etc., took part. It is possible that next year, or later, the Canadian Section of the Society of Chemical Industry may undertake the establishment of a distinct chemical section of this Fair.

BRITISH INDIA.

Industries in Travancore.—An industrial survey of Travancore was recently undertaken by Dr. S. G. Barker, and his report shows that this State possesses very considerable assets both vegetable and mineral. Among the more important industries indicated are shellac, sugar, fibres, dyeing and weaving, and on these immediate concentration of effort is advised. One experiment of especial interest mentioned in the report is the manufacture of acetic acid from the shell of the coconut, for this acid has an important use in the manufacture of rubber, an enterprise which is being taken up by a large number of people in the State. The high price of the acid makes it difficult to carry on the work, and experiment has shown the possibility of cheap and easy production of the acid. Travancore is not in a satisfactory position as regards power, as there is no coal and but few of the waterfalls survive the hot weather. As regards motor spirit, Travancore proposes to strike out in a direction which will produce results of value to the country at large. The Government has a big distillery in the south of the State, and experiments are being made for the employment of the alcohol distilled there to drive engines of small power.—(*Indian and Eastern Engineer, Aug.*, 1919.)

AUSTRALIA.

Minerals in South Australia.—The discovery on the western shore of Gulf St. Vincent of good grade alunite in quantities sufficient to justify the erection of an extraction plant may go far to supply the Australian demand for potash.

Large deposits of low-grade calcium phosphate and aluminium phosphate are known to exist, but have not as yet been exploited.

Prospecting operations in one of the graphite deposits of Eyre's Peninsula have been so encouraging that initial steps have been taken to put up plant there. A Government scheme, operative until 1922, offers a bonus of £1 per ton to persons recovering and marketing graphite locally.

A bonus of £5000 is also offered by the State Government to the person or firm first obtaining 100,000 gallons of crude petroleum which will yield 90 per cent. of useful distillation products.—(*Times Trade Suppl., Sept.* 27, 1919.)

UNITED STATES.

Importation of "Vat" Colours.—Owing to the shortage of vat dyes, the War Trade Board has authorised the importation of six months' supply, and Dr. C. H. Herty, editor of the *Journal of Industrial and Engineering Chemistry*, has been commissioned to effect the necessary purchases in Europe.

Cotton Oil Extraction.—As a result of industrial research, a cotton-oil company has found it possible to recover an average of 13 lb. of oil per ton of seed more than the general average in the industry, and to obtain ½ per cent. more first-grade oil in its refining processes. The meal with lower oil content is more desirable.

Electro-deposition of Gold and Silver.—The U.S. Bureau of Mines Bulletin 150, relating to the electro-deposition of gold and silver from cyanide solution, and prepared by S. B. Christy, is a careful record of experiments covering all phases of the subject, and should be of great value to all investigators of the electrolytic deposition of metals. At intervals over a period of 20 years Prof. Christy has studied the problem, and the monograph records the large amount of experimental work performed.

The Chemical Warfare Service.—The proposal to abolish the Chemical Warfare Service as a separate unit of the United States army and to place its work under the Engineers is being fought by all those really familiar with what is involved. Any future war is almost certain to be one fought along chemical lines, and the Chemical Warfare service has more possibilities than any other branch of the military establishment. It is estimated that in the late war 30 per cent. of the American casualties was due to the chemical warfare of the enemy. There is always a strong possibility that researches in chemical warfare will yield results important to peaceful pursuits, and such research should be continued independently of other military branches.

JAPAN.

Sugar Industry.—The fiscal year ending June, 1918, was a poor one for the Japanese sugar industry. The output of the sugar companies in Formosa during this period was less than 300,000 long tons, being about 134,000 tons below the estimated output. The steady advance in the price of fertilisers and freight rates, coupled with the comparatively low price of Java sugar, had a bad effect upon business. The net profits of the ten leading Japanese sugar companies are estimated at 23,414,756 yen. Large profits are expected for 1918-19. The price of Java sugar has shown an upward tendency, and the price of Japanese sugar has also risen. The output for the year is estimated at 263,000 tons, a little over half of which will be exported.—(*U.S. Com. Rep., July* 29, 1919.)

Camphor Production in Formosa.—The causes of the decreased production of camphor in Formosa during the past three years are summarised as follows:—There is a shortage of labour to gather the crude material, due partly to the higher wages paid by other industries, especially the sugar industry, and partly to the necessity of going further and further into districts menaced by savages in order to get good trees. Labourers prefer to work in safe industries, since the wages they can receive are equal to or even greater than the wages paid in this comparatively dangerous occupation. Good trees have become scarce because of the wanton and unorganised cutting down in the past.

An amalgamation of the various operating companies has recently been effected with the object of systematising the method of gathering the camphor and preventing waste. The combination will also be in a better position to procure labour and to negotiate with the Government in regard to prices. The Camphor Monopoly Bureau does not anticipate that the production will be brought back to the normal until the fiscal year beginning April 1, 1920. From then onwards the annual output is expected to reach 5—6 million kin (3000—3600 long tons); this year it should be at least 4 million kin (2000 tons). The Government is now engaged on investigations into the prospective production from all the wild trees in the island, but these will not be completed for three or four years. It is roughly computed that these trees will yield 5 million kin of camphor a year for the next 10—15 years, after which the trees planted by the Formosa Government will be available.

The Japanese Government has instructed Japanese refiners to sell to refiners in the United States 20,000 lb. of camphor per month at 3 per cent. less than the market price. No stocks of camphor are held over by the Monopoly Bureau.—(*U.S. Com. Rep.*, Aug. 4, 1919.)

GENERAL.

The Effects of Shift-Duration, Seasonal Variation of Temperature, and Ventilation on Output.—Report No. 1 of the Industrial Fatigue Research Board is devoted to a discussion of the influence of hours of work, of temperature and of ventilation, on output in tinplate manufacture. The records of five tinplate works, extending in some cases from 1911 to 1918, and detailing the hourly outputs in fortnightly periods, have been examined. The most reliable records indicate that over periods each including hot and cold seasons in about equal proportions, the average hourly output when working on six-hour shifts was about 11·5 per cent. greater than when eight-hour shifts were being worked. Smaller increases of hourly output, varying from 4·7 to 10·6 per cent., accompanied the reduction of hours in the case of other works in some of which four-hour shifts were being worked. On the average, the hourly output of six-hour shifts is about 10 per cent. greater than that of eight-hour shifts.

In a factory with no system of artificial ventilation and working on eight-hour shifts, the average hourly output during August was 9 per cent. below the average. Thereafter the hourly output rose uninterruptedly to 9 per cent. above the average in January, subsequently falling without interruption except for the month of June. Furthermore, in this unventilated factory, the hourly output was 10 per cent. above normal when the external temperature was under 40° F. (=4·4° C.), and fell continuously to 10 per cent. below normal as the external temperature rose to 65° F. (=18·3° C.). The seasonal variation in the case of a factory possessing good ventilation was found to be ± 3 per cent. above or below normal. Allowance being made for weekly and monthly variations in output, it appears that the output in the unventilated mill during the hottest weather was probably 30 per cent. less than during the coldest.

The Petroleum Fields of Alsace.—The exploitation of these fields was begun by the Germans in 1860. In 1912 wells covering 625 acres were producing 47,176 metric tons of oil, and when war broke out developments were in progress which aimed at an annual production of 70,000 tons. The projected new work could not be carried out during hostilities; the production, nevertheless, increased considerably. The oil, which is generally found in pockets at 650 ft. to 1650 ft., and sometimes at 2300 ft., is heavily charged with saline water containing in grams per litre: $NaCl$ 7·96, KCl 0·66, $CaSo_4$ 1·75, and $MgCo_3$ 0·54. American methods of boring are followed; there are no gushers, and the oil is pumped up by electrically-driven Canadian pumps. The oil is conveyed to the refinery by five pipe-lines with a total length of 37½ miles and covering a radius of 6-7½ miles. In chemical character the Alsatian oil is intermediate between American and Rumanian oils, with an average density of 0·92, and percentage constituents as follows: Motor spirit 5, kerosene 20, heavy oils 65, and residual matter 10.—(*Rev. Gén. de l'Elect.*, Aug. 23, 1919.)

Direct Ammonia Recovery.—The total production of ammonia in the United Kingdom during 1918 was 6 per cent. less than that during 1917. This reduction, although partly due to the poor quality of the coal carbonised, is mainly attributable to the improved methods of carbonisation, including steaming of the charge employed, whereby the weight of coal carbonised per unit volume of gas distributed tends to be continually reduced. Meanwhile, the yield of ammonia per ton of coal carbonised is increased, and the total production of ammonia is determined by these two factors which operate in counter directions. The Chief Alkali Inspector in his Report for 1918 directs attention to the fact that at the Halifax gasworks the yield of sulphate of ammonia per ton of coal carbonised has been increased from the normal amount of 24lb. to 30·54 lb. by charging the retorts with coal which had been sprayed with water. The results obtained

by this practice cannot be regarded as conforming with the general opinion that superheated steam is necessary for steaming the retorts.

The "backward rotation" system of gas purification, combined with downward travel of the gas in the purifiers, possesses a number of advantages when employed in conjunction with the "direct" process of ammonia recovery (see this issue 708 A). In the light of experiments detailed in the report above mentioned it appears that the oxide employed in the first members of a series of oxide purifiers undergoes concurrent sulphiding and revivification. This being accepted, it appears that the correct point for air admission to the purifiers is the first member of the series, in contradistinction to the more common practice of admitting air about midway in the series.

Processes for the manufacture of sulphate of ammonia without the consumption of sulphuric acid other than that derivable from constituents of the crude gas have not hitherto met with much success. In a new process due to Prof. J. W. Cobb, the gas is passed into a solution of zinc sulphate, ammonium sulphate being produced with precipitation of zinc sulphide. The solution is filtered and ammonium sulphate obtained by evaporation of the filtrate. The zinc sulphide is roasted, and the gases evolved, together with an excess of air, are blown through water holding in suspension zinc oxide from a previous roasting. Zinc sulphate is regenerated in this manner. The process is now being tried in a plant capable of yielding one ton of ammonium sulphate per day. The original Feld process of ammonia recovery has been recently modified, the gas being now washed with a solution of ammonium tetrathionate in place of the solution of ferrous sulphate previously employed.—(*Times Eng. Suppl., Sept.*, 1919.)

Distillation of Oil-Shale in Germany.—Prior to the outbreak of war shale was worked in the Rhine provinces and near Reutlingen, but only one company was occupied in producing paraffin and mineral oils. From the bituminous shale which occurs near Messel (containing 40 to 45 per cent. water, 6 to 10 per cent. tar, and 40 to 50 per cent. residues), the following yields per ton of shale are obtained: 135 litres of crude oil, together with 295 litres of ammonia water and 59 cub. m. natural gas, which is burnt as fuel in gas engines or under the vertical retorts. During the war the oil-shale deposits in South and North Germany have been investigated in regard to their yield, but the results have not yet been published.—(*Z. d. Ver. deut. Ingen., July* 19, 1919.)

The Nitrogen Works at Leuna, near Merseburg (Germany).—Dr. Semmler, a member of the German National Assembly, has recently described a visit which he paid to these works in company with other parliamentary and Government representatives. The first sod was dug in May, 1916, and the first output of ammonia achieved in April, 1917. The factory, which is now only three-quarters completed, employs 7000 labourers in addition to a like number of regular employees. The daily output of combined nitrogen is roughly 200 metric tons; eventually it is hoped to produce 560 tons. The main product is 20 per cent. ammonia solution, some of which is transported elsewhere for conversion into nitrate. Owing to the excessive cost of sulphuric acid, ammonium sulphate is being made by the interaction of ammonia with calcium sulphate in a current of carbon dioxide. The daily consumption of lignite is about 11,000 tons, and of water about 15,000 cub. m. per hour, 90 per cent. of which is recovered and re-used. The works contains a store with a capacity of 250,000 tons of ammonium sulphate, equivalent to three months' production.—(*Oester. Chem.-Zeit., July* 1, 1919.)

Soap from Lignite Tar Oils.—Experiments, which are said to have been satisfactory, have been carried out in the laboratory of the Siemens works in Berlin, with a view to converting lignite tar oils into fatty acids by the action of ozone. Similar experiments carried out on a large scale by a process introduced by the City of Wiesbaden are reported to have been equally successful. By treating the fatty acids with potash lye, a lubricating soap giving a good lather is obtained, and treatment with soda lye gives a solid product which can be pressed in moulds. Also by ozonising acetic, propionic, and butyric acids and unattacked gas oil a colourless, high quality paraffin wax results. —(*Mitteil. d. Reichsb. Deut. Tech. No.* 24, 1919.)

The Beet Sugar Industry in Bulgaria.—After a promising start the Bulgarian beet sugar industry has been falling off, especially during the war; although there was a slight increase in production during 1917–18 over 1913–14, the figures being 11,000 tons for the former and 7800 tons for the latter period. During the war, when Austria exported sugar to Bulgaria and Turkey, the price of sugar was about 10 leva, say 8s., per pound; it has now risen to nearly £1. The responsibility for poor yields of beets can be fixed in a very large measure on the growers themselves, inasmuch as the cultivation of the roots is inferior. In many cases the ground is simply ploughed up, the seed sown broadcast, the field hoed once and then left without any further attention until the autumn. And yet it has been proved by experiment that good crops can be grown there. However, the growers seen very unwilling to accept advice offered to them, so that the yield per acre remains poor, in some cases as low as 120 lb. per acre. Also, many growers prefer to prepare their favourite *rakia* from the roots to delivering them to the factory. The Government could do much to help the industry forward by providing better transport facilities, and by paying the growers better prices for their roots. They are receiving 15 leva, or about 11s., per ton of roots, whereas the return for cereals approaches £80 a ton. Until Government aid is forthcoming the prospects of the industry will remain uncertain, and the whole population will continue to demand the importation of sugar from abroad.—(*Deutsch. Zuck. Ind., June* 20, 1919.)

The Russian Beet Sugar Industry.—France, Russia, and Germany may pride themselves on having the longest established beet sugar industries. They all date from the beginning of the 19th century. Germany and Russia, together with Austria, are still the largest beet sugar producing countries of the world. The following figures will be useful for demonstrating the relative positions occupied by them as regards their annual sugar output for two consecutive years taken at random:—

	Metric tons. 1909.	1910.
Germany	2,640,000	2,502,000
Austria	1,246,000	1,542,000
Russia	1,124,000	2,115,000

The first Russian beet sugar factory was erected in the Government of Tula in Central Russia in 1802. All the early factories were of a very primitive character and many were provided with insufficient capital. Up to the year 1825 there were only two factories. Later on the number increased rapidly, so that in 1861 there were no less than 432 factories with an annual output of 64,400 metric tons. This vigorous growth was checked by the emancipation of twenty-three million serfs by Alexander II. in 1861 with the result that in 1863, with 402 factories still working, the actual production was reduced to about one-half. Since then the industry has developed continuously and has assumed a more modern character. The introduction of steam and of the diffusion process into the works accounts largely for this progress. Thus

in 1903-4 the output was 1,022,000 tons; in 1908-9 1,375,000; and in 1913-14 1,791,000 tons. In 1914-15 the output was 1,739,000, a figure which does not include sugar manufactured in Poland. During the war the production decreased considerably and for 1917-18 it is given as 1,100,000 tons only. The low production during the war may be ascribed to shortage of beet acreage, partly accounted for by the German occupation, and to inferior crops due to shortage of fertilisers.

The annual consumption per head in Russia is very far behind that of other countries. In 1900 it had increased to 8·4 lb. and to double that amount, namely 17 lb., in 1918. During the war the increase in consumption was maintained owing to the requirements of the military administration, the increased purchasing power of the population and the prohibition of spirits which increased the consumption of tea. The larger consumption and the lower production effectively put a stop to all export, with the exception of limited quantities to Finland and for a time to Persia, where it was exported for the purpose of creating funds for the expenditure incurred by the Russian armies. The continuous rise in the price of the raw material is due partly to the fact that some estates have passed into the hands of peasants who prefer raising cereals to growing roots. Therefore, if the industry is to thrive in the future it will have to be very well organised and supplied with the best technical advice.

In regard to technical development Russia undoubtedly takes first place among beet-growing nations, and many of the improvements have been made by Russian inventors. A good illustration of the satisfactory progress made by the industry is given by the fact that whereas in 1880 only 7—8 per cent. of sugar was extracted, in 1913 the extraction had increased to 10—11 per cent. This improvement led to a decrease in the cost of production of 23 per cent. during the ten years before the war. As much attention as possible will also have to be paid to making full use of by-products. Black molasses, containing 45—50 per cent. of sugar, which is not extracted, is already being employed for the purpose of improving cattle food and in brandy distilleries. The exhausted pulp is employed exclusively for cattle food either in the raw or in the fermented condition.

The first attempt to introduce the sugar industry into Siberia was in the Government of Tomsk. It failed through lack of capital and was followed by the erection of a factory in 1889 in the Government of Yeniseisk in East Siberia. It closed down in 1898, again through lack of working capital and adequate factory equipment. Now the Omsk Government has undertaken to develop the industry in Siberia and for that purpose is offering 30,000 acres of land and other privileges to each factory.—(*U.S. Com. Rep., July* 8, 1919.)

Production of Wolfram in Portugal.—Many tungsten minerals are found in the central and northern Portuguese provinces of Minho-e-Douro, Traz-os-Montes, Beira Alta and Beira Baixa, and the ore worked averages 55—65 per cent. of tungstic acid. The total production is estimated at 900—1500 tons yearly. Before the war the cost of production was approximately 300—450 escudos (£67—£100: escudo = 4s. 5½d.) per ton, but recently this has risen nearly 200 per cent. The mines are owned by an American company, and all the ore produced is exported. The industry has been paralysed since the termination of hostilities. Mine owners have protested against the production tax of 180 escudos per ton, imposed in 1917, for there is also an export duty of like amount. A commission is now considering a new law to be presented to the Government, which it is hoped will remove many of the obstacles impeding the development of this industry.—(*U.S. Com. Rep., July* 24, 1919.)

LEGAL INTELLIGENCE.

Customs Seizure of Pyrogallic Acid.—*J. Brown v. W. Buckley.*

Before the Vacation Judge, Mr. Justice Greer, on September 24, a motion was heard on behalf of the plaintiff in an action by John Brown, dealer in chemical materials, of London and Manchester, against W. Buckley, an officer of H.M. Customs and Excise at Manchester. The plaintiff asked for an interlocutory injunction to restrain the detention of 5 cwts. of pyrogallic acid bought by him from the Mallinckroft Chemical Works, Ltd., of Montreal, Canada, and shipped from New York to Manchester in July and August, 1919.

It appeared that, according to the plaintiff's case, the goods were detained by the Customs authorities at Manchester upon the authority of a Royal Proclamation made in connexion with the Customs Consolidation Act, 1876 (Sec. 43), which said "the importation of arms, ammunition, gunpowder, or any other goods may be prohibited by Proclamation or Order in Council." The plaintiff said that the Act did not purport to prohibit the importation of pyrogallic acid, nor could the acid conceivably come within the categories of goods set out in the Proclamation in question. Further, even if pyrogallic acid was covered by any general description in any Prohibition of Import Proclamation, it was a chemical well known as a commercial article, was only used in the development of photographs, and it was in no sense a substance which could come under the general description "ammunition or gunpowder," nor was it in any sense a substance *ejusdem generis* with those substances. Plaintiff maintained that the detention was wrongful and asked for relief.

The Attorney-General (Sir Gordon Hewart), for the Customs authorities, submitted that as the plaintiff had started an action in which the whole question of the validity and meaning of the statute would be raised, the present interlocutory application was misconceived. He also said that the meaning of the Section was by no means as clear as had been suggested on behalf of the plaintiff. The Customs were anxious that it should be dismissed and decided when the trial came on, but not upon an interlocutory motion. Even if the plaintiff succeeded the order would be nugatory, as the goods were under the control of the Board of Customs subject to the Act.

Mr. Justice Greer said that he could not decide the question now; it was one of general importance to merchants, and the parties must apply to Mr. Justice Younger (in whose list the action was set for an early trial). While giving no decision, he was inclined to think that the construction contended for on behalf of the plaintiff was correct. He refused the application, and made no order as to costs, except that they should be reserved to the trial of the action.

Application for Use of German Patents.

An application was made on October 7 to the Comptroller of Patents on behalf of Messrs. Brunner, Mond and Co., Ltd., for licences to work under ten patents of the Badische Anilin and Soda Fabrik, nine of which apply to the manufacture of ammonia and one to the purification of oxygen. The patents in question are Nos. 17,642/09, 17,951/09, 14,023/10, 19,249/10, 19,778/10, 5833/11, 5835/11, 21,151/11, 28,167/11, and 44,509/10.

The grant of the licences was recommended.

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REPORTS.

FUEL ECONOMY.

A REPORT ON THE PRESENT STATUS OF FUEL ECONOMY IN THE GERMAN IRON AND STEEL INDUSTRY OF THE OCCUPIED TERRITORY ON THE LEFT BANK OF THE RHINE. *Presented to the Iron and Steel Institute by* COSMO JOHNS AND L. ENNIS.

This report records the condition of affairs as found in April, 1919, but owing to the peculiar industrial conditions then prevailing, the trend of progress, as conceived by the authors, is also indicated. The iron ores of the Lorraine district contain less than 30% iron, but can be made up into self-fluxing mixtures which require an addition of one-third of their weight of coke. Except in the Saar Valley few works have their own coke ovens, but depend upon rail-borne Westphalian coke. It was found that the coke constituted 54 per cent. of the cost of pig iron.

The Germans have concentrated their efforts upon the best utilisation of furnace gas. The actual coke consumption per ton of pig iron was (April, 1919) 1125—1500 kilo., being about 200 kilo. greater than the pre-war consumption. One new furnace in the Rombas works was noticed with only three stoves, but with the addition of two recuperators, which utilised the heat in the combustion products from the stoves to pre-heat the air used for combustion.

The dust content of the gas was always reduced to about 0·1 grm. per cu. m. before being used for any heating purpose. Wet towers and fans, the Zschocke wet system, and the Halberg-Beth dry system were noted, and at all works great importance was attached to this matter. With clean gas the efficiency of the stove is increased, leaving a greater surplus for other purposes. Theisen washers were used for the second cleaning of the gas for internal combustion engines; these reduced the dust content to about 0·002 grm. per cu. m., and served to cool the gas. A feature of the works visited was the installation of large gas engines of 1500—5000 h.p., working on cleaned furnace gas. The policy was to make the best use of the power thus generated for the compression of air for blast furnaces and converters and for generation of electric power for rolling mills, etc., so that the maximum quantity of surplus gas was available for steam raising and for furnace heating. Although the gas engine was prominent in the system, steam-turbine-driven generators were usually added to provide elasticity. At the Volkingen works the exhaust gases of a 3000 h.p. gas engine were used in a waste heat boiler.

In most cases the blast furnaces are combined with the steel works, the bulk of the liquid pig iron being treated by the basic Bessemer process. The basic open-hearth furnaces, dealing with scrap from the mills, used 20—25% of pig iron in their charges and produced ingots with a coal consumption of 250 kilo. per ton. Pig iron containing less than 1% silicon and 0·06—0·07% sulphur was being regularly made and did not necessitate the use of active mixers. Such mixers as were used were simply heated by blast furnace or coke oven gas.

The furnace gas contained 10% CO_2, 28% CO, 4% H_2. The tendency is to use regenerated or enriched blast furnace gas for the purpose of reheating ingots.

The power requirements of the majority of steel mills are at present met by tandem compound condensing steam engines, the steam being generated mainly in gas-fired boilers. The Hagondange mills, however, are completely electrified, and probably this represents future practice after the linking up of power stations has been developed.

Proposals which have not yet established themselves in practice are:—1. The electrostatic precipitation of dust from the furnace gases. 2. The enrichment of blast with oxygen. 3. The conservation of the surplus furnace gas at week-ends.

The authors' recommendations for the promotion of fuel economy are:—1. The furnace gas should be cleaned without loss of sensible heat where possible. 2. All power should be generated in gas engines with only such steam turbines as are necessary to provide elasticity. As much steam as possible should be furnished by waste-heat boilers of the fire-tube type attached to the gas engines. 3. Power stations should be linked up to render practicable the electrification of steel works. 4. Cleaned furnace gas should be the principal fuel in melting and reheating furnaces, and also, after enrichment, in open-hearth furnaces.

REPORT ON TRADE CONDITIONS IN BRITISH EAST AFRICA, UGANDA, AND ZANZIBAR. BY T. SLEITH. *Department of Mines and Industries, Union of South Africa. Pp.* 64. (*Cape Town: Cape Times, Ltd.*, 1919.)

In 1918 the author of this report was commissioned by the Union Government to undertake a tour lasting four months with the object of investigating the possibility of stimulating trade between these East African colonies and the Union of South Africa. The main impression he brought back was that Central Africa is of primary and paramount importance to the Union as a source of certain raw materials and products. There exists an unlimited supply of copra, palm oil, groundnuts, sim-sim, sisal, beeswax, hides, and skins, and other commodities of equal industrial importance.

British East Africa.—The principal exports are, in order of decreasing value, hides and skins, fibre, grain and oil seeds, coffee, carbonate of soda, copra. The export of hides and skins will grow as the cattle industry develops. More than 96% of these exports, valued at £156,056 (ox hides, £123,396; goat skins, £31,291) go to the United Kingdom.

Attention is again being directed to the wattle bark industry, hitherto a failure owing to low prices, high freights, and to climatic conditions preventing the air-drying of the bark; 16,000 acres is now under black wattle, and the erection of tannin works is contemplated.

Sisal constitutes 98 per cent. of the total production of fibre; £129,555 worth was exported in 1917, and practically all of it went to the United Kingdom. In 1917, 20,000 acres was under sisal; it is now the premier crop of the Protectorate, although the cultivation, which is not suitable for small settlers, was begun only in 1908. The pre-war price in London of £35 to £45 a ton rose in 1918 to about £100. Much attention is being given to the cultivation of flax, of which there is now about 10,000 acres in the Protectorate, but this area will soon be very largely increased. Cotton is not at present to be reckoned among the resources of British East Africa, nor is wool, of which the exports are valued only at £12,327.

Owing to the local consumption of grain by the military forces the total exports of grain and oilseeds have recently much diminished; sesamum is the principal crop. The cultivation of maize, for which there is cheap labour and illimitable land of suitable quality, is extending.

The production of copra is practically stationary. In 1917, Italy and France took over 80 per cent. of the total of 28,748 cwts. exported.

The Magadi Soda Lake, 60 miles south of Nairobi, covers 30 square miles and contains an inexhaustible supply of very pure natural soda (constantly being added to by the hot springs) of which 200 million tons is actually exposed. The crystalline blocks consist of a sesquicarbonate of soda free from sulphate which, after drying and crushing, is exported in bags to America, Great Britain,

Africa. This natural soda contains twice as much sodium carbonate as soda crystals, and is therefore economical as regards freight; it is stable in air and may be used instead of high-grade soda ash. In block form it is used in Africa and India as a "salt-lick" for cattle. The quantity exported in 1917 was 2163 tons, valued at £45,056. The production is expanding rapidly.

Soap was imported from Europe in 1917 to the value of £70,000. The South African product of equal quality is said to be excluded by a territorial arrangement between the leading manufacturers. Candles are obtained at present from Burmah and India. The current supply of matches from Japan and India is of the very poorest quality.

There are enormous timber reserves in British East Africa, the greater part being found in the Highlands. Certain areas are being exploited, and the industry is expected to become very important in the near future. Very little timber has so far been exported, but the Government is considering the question of improving harbour facilities for this purpose. The chief varieties available are:—Ironwood, *Olea hochstetterii*, which is almost identical with the South African ironwood—*Olea laurifolia*. It is of great strength and durability, and possesses a very beautiful grain. Its weight is 59 lb. per cub. ft., and there are approximately 500 cub. ft. to the acre. Another excellent wagon wood is "red stinkwood," *Pygeum Africanum*, which, when seasoned, weighs 48 lb. to the cub. ft.; it is not plentiful. Yellowwood, *Podocarpus tracilier* or *Podo*, is comparable with the Kauri of New Zealand. It makes good railway sleepers and construction timber when creasoted. A great future is predicted for this timber, of which many hundreds of thousands of acres exist. The yield is 2000 cub. ft. to the acre, and the weight 37 lb. per cub. ft. Cedar or *Juniperus procera*, which is also very abundant, is much used for building purposes, and is immune to white ants. After 5 years' air drying the average weight is 36 lb. per cub. ft. The price of each of the above-mentioned woods was Rs. 5 per cub. ft. f.o.b. Kilindini.

The Indian community plays a very important part in the commercial affairs of this Protectorate, and a very powerful "Indian Association" exists to promote the interests of Indian traders.

Uganda. Here also the Indian trader is prominent, and his influence is extending. The cultivation of cotton, extending over 133,000 acres, is almost entirely in native hands and is increasing yearly. In 1917, the exports were worth £560,000. Attempts to cultivate sisal some years ago were abandoned. Flax has recently been planted on an experimental scale. The plantain, grown extensively for food, may prove a source of fibre, and the production of raw silk and paper pulp (from elephant grass) are possible developments. Between 10,000 and 15,000 tons of cottonseed, yielding about 12 per cent. of oil, is available annually, but owing to the cost of freight it is practically valueless, and is used for fuel or manure.

Exports of sim-sim in 1916—1917 were 1905 tons. The bulk of the groundnuts and sim-sim formerly went to France. The castor oil plant, the shea nut tree and others of potential value for oil extraction grow wild in Uganda, but have not been commercially developed. Small quantities of beeswax are available. The acreage under Para rubber is about 6000, and of other varieties about 1500; the cultivation is extending. Efforts are being made to improve the quality of hides and skins, of which 1100 tons was exported in 1917-18. Since 1914 native timber has successfully replaced the imported, but there is at present no indication of the development of an export trade. No coal or other minerals of importance have been discovered, and wood fuel is used exclusively. Among the products in demand are paints and distempers and cheap perfumery.

Zanzibar. Clove cultivation, mainly by Arabs, is the chief industry, and about 60,000 acres is under cloves in the islands of Zanzibar and Pemba which yield the bulk of the world's supply. Exports in 1917 were valued at £436,242, of which 66% went to India, 17% to the United Kingdom, and 14% to the United States. Before the war Germany was the second largest buyer. The coconut industry ranks second and the export of copra is steadily increasing, but owing to the lack of drying facilities the product is inferior to that of Cochin or Ceylon. Until the end of 1914, Marseilles was practically the sole market for Zanzibar copra; in 1915 British South Africa became a factor in the market, and later, Italy. Exports in 1917 to the value of £299,653 were distributed between Italy (76%), British South Africa (17%), and France (3.3%). Guano can be obtained in large quantities on the islands adjacent to Zanzibar and on many other islands off the East Coast. Bunker coal, formerly imported from Wales, is urgently required, as is also ammonia for ice plants at Zanzibar and Dar-es-Salaam, and vinegar.

GOVERNMENT ORDERS AND NOTICES.

PROHIBITED EXPORTS.

Headings transferred from one list to another.

From List A to List B:—Aircraft, other than balloons, of all kinds and their component parts, together with accessories and articles suitable for use in connexion with aircraft.

Deleted Headings.—(A) Malt; (A) beer and ale; (A) cakes and meals, the following:—Fishmeal and concentrated fish.

Trading with late enemy and other countries. The Board of Trade has issued new notes on this subject superseding those published in July last. The notes cover the following countries:—Germany; the former Austro-Hungarian Dominions; Turkey and Bulgaria; Norway, Sweden, Denmark, Holland and Switzerland; Poland, Finland, Esthonia, Lettland and Lithuania.

Export Credits. The Board of Trade has made certain alterations in and additions to the scheme of export credits (this J., 1919, 339 R). Full particulars are available at the Export Credits Department, 10, Basinghall Street, E.C. 2.

NEW ORDERS.

MINISTRY OF TRANSPORT. By an Order in Council of September 22 last, the powers of the Board of Trade in relation to railways, light railways, tramways, canals, waterways and inland navigations, roads, bridges and ferries (with vehicles and traffic thereon), harbours, docks and piers were transferred to the Minister of Transport.

THE 1918 CROP RESCUTCHED TOW (IRELAND) (CANCELLATION) ORDER, 1919. Ministry of Munitions, September 26.

THE GAS AND COAL (EMERGENCY) ORDER, 1919, issued on September 26, requires gas undertakings to limit their coal consumption to the production of a gas of 15 per cent. lower quality than that previously supplied, and not exceeding 425 B.Th.U. in calorific value, and authorises reduction of pressure in gas mains at certain periods of the day or night.

MAXIMUM PRICES OF PETROL. New maximum prices were issued under an Order of the Board of Trade on October 1, and these were revised on the following day. The revised wholesale prices for spirit in cans are:—Aviation, per gallon, 3s., special boiling points 2s. 11½d., No. 1 2s. 8d., No. 2 2s. 6d. Maximum retail prices 4½d. per gall. more.

OFFICIAL TRADE INTELLIGENCE.

(From the Board of Trade Journal for September 25 and October 2.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 4, Queen Anne's Gate Buildings, S.W. 1, from firms, agents or individuals who desire to represent U.K. manufacturers or exporters of of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

Locality of Firm or Agent.	Materials.	Ref. No.
Australia	Chemicals	673
"	Dyes for leather and woollens, tanners' supplies, leather, lubricating oil	676
"	Glassware, crockery, aluminium goods	680
British India ..	Glass, china, leather, soap, chemicals, medicines, perfumery ..	733
Canada	Druggists' sundries, rubber goods ..	737
"	Chemicals for pulp and paper manufacture, paint, soap, fertilisers ..	*
"	Glassware, china, stoneware ..	*
British West Indies	Carbon dioxide, galvanised iron (corrugated), cement, manures ..	689
Egypt	Chemicals, colours, varnish	691
"	Chemicals, dyes, paint, distemper, varnish, caustic soda, lubricating oils (also catalogues and price lists wanted)	693
Hong Kong ..	Ammonium sulphate, dyes, drugs, industrial chemicals	744
Newfoundland ..	Metals, oils	742
Austria	Copper compounds, soap, candles ..	746
Belgium	Piano wire, resistance wire, thermometers, resin solder	700
"	Hæmatite, pig iron, spiegel, ferro-manganese, ferro-silicon	701
"	Metal sheets for roofing, fertilisers	748
"	Pig iron, cast steel	749
Czecho-Slovakia ..	Drugs	707
" ..	Copper, tin, nickel, aluminium, brass, lead, tanning materials, phosphates	755
France	Boric, citric, carbolic and sulphuric acids, permanganate, copper sulphate, etc.	710
"	Iron, cast iron, paint, varnish, linseed oil	715
Greece	Sugar	718
Italy	Chemicals	721
"	Soap, perfumery	761
"	Oils, fats	†
Norway	Galvanised corrugated sheets, cement	722
Spain	Tinplate, galvanised iron	726
"	Sheet zinc and tin, galvanised iron ..	727
"	Oxalic acid, tripoli, emery, bismuth, ammonia, essences, lac, etc. ..	728
"	Skins, leather, grease	729
"	Essence of aniseed	766
"	Iron, metals, lubricating oils ..	768
" (Canary Isles)	Paints	731
Switzerland ..	Optical goods	771
United States ..	Hides, skins	778
Argentina, Brazil ..	Pottery, stainless cutlery, etc. ..	780
Guatemala ..	Paints	783
Central and South America ..	Drugs, medicines, etc.	784

* The Canadian Government Trade Commissioner, 73, Basinghall Street, E.C. 2.

† The British Chamber of Commerce for Italy, Via Silvio Pellico, 12, Milan.

Markets Sought.—Canadian firms desire to get into touch with U.K. importers of natural oxides, ochres, sulphur, sulphuric acid, zinc oxide and soda ash. Inquiries should be addressed to the Canadian Government Trade Commissioner, 73, Basinghall Street, E.C. 2.

A merchant at Hong Kong desires to get into touch with U.K. importers of peanut oil, cassia oil, aniseed oil, camphor oil, tea oil and lard. Inquiries should be addressed to the Department. [Ref. No. 745.]

TARIFF, CUSTOMS, EXCISE.

Argentina.—The export of sugar is prohibited as from Aug. 8, and the re-export after Sept. 15.

Goods for Patagonian ports may be transhipped at Buenos Aires, customs duties being paid in Patagonia.

Brazil.—The regulations laid down in the Budget Law for 1919 respecting the specification of goods in Consular invoices has been prorogued indefinitely.

Bulgaria.—The new import and export regulations are set out in full in the *Bd. of Trade J.* for Oct. 2. Among the articles on the free list are many food stuffs, condensed milk, certain vegetable oils, cod liver oil, washing soap, candles, tar, glue, vaseline, heavy mineral oil, tanning materials, coal tar dyes, mineral colours, chalk, ink, ammonium sulphate, medicines, cement, pottery, porcelain, glass, paper, cardboard, hides, skins, leather, rubber, gutta-percha, ores, metals, alloys, and scientific instruments.

Czecho-Slovakia.—The conditions generally governing the issue of import licences and the payment for shipments are given in the *Bd. of Trade J.* for Sept. 25. Articles in demand include seal oil, iron ore, ferro-manganese, salt, nickel, copper, tin, zinc ore, saltpetre, phosphates, magnesia, pyrites, rubber, tallow, turpentine, amorphous phosphorus, quebracho extract, and hides.

Cuba.—Only legally authorised pharmacists and druggists attached to a hospital, clinic or similar institution may import or produce opium, Indian hemp, chloroform, ether, chloral hydrate, morphine, narceine, heroine, dionine, poronine, cocaine, novocaine, tropocaine, eucaine, stovaine, mariguane, and other products specified as being prejudicial to health.

The original order may be seen at the Department of Overseas Trade.

Egypt.—The customs duty on copper, brass, tin, lead, zinc, antimony, quicksilver and phosphor bronze has been amended as from Sept. 1.

Esthonia.—A copy of the regulations governing foreign trade is set out in the *Bd. of Trade J.* for Sept. 25. The importation of, *inter alia*, iron, steel, grain, sugar, salt, petroleum, benzine, naphtha, lubricating oil, machine and cylinder oils, and leather may be effected without special permit. The import of fancy goods and unnecessary articles is entirely prohibited. The import of all other goods is only permitted by the sanction of the Council for Foreign Trade.

France.—Wine may now be imported without restrictions subject only to the usual customs formalities.

Germany.—General import prohibition remains in force, but lists of free imports will be issued. All raw materials are to be admitted without licence, but half-finished and finished goods will be under control.

Italy.—The new tariff is unlikely to become effective until next year.

Netherlands.—The prohibition of the export of ether has been temporarily raised.

Morocco (French Zone).—The prohibited export list still includes cereals, wood charcoal, and soap.

Rhodesia.—Certificates of origin and interest are no longer required for goods imported into Southern Rhodesia.

South Russia.—All exports from South Russia are duty free.

The sugar monopoly has been abolished and excise duties are now leviable on sugar, matches and tea.

United States.—It is proposed to promote the production of tungsten ores and manufactures thereof by levying a customs duty upon imported tungsten, its ores, alloys and concentrates.

COMPANY NEWS.

MAGADI SODA CO., LTD.

At the eighth ordinary general meeting, held in London on September 22, Mr. S. Samuel, M.P., who presided, said that the trading loss of £48,954 was more apparent than real, as a large proportion of the expenditure on labour would not recur. The sales, less charges, amounted to £12,081. Very serious labour troubles had occurred in East Africa just when production was on the point of starting. The cost of labour had increased by about 200 per cent., and owing to the war it had not been possible to carry into effect the decision to eliminate as far as possible manual labour by substituting mechanical appliances. About the middle of this year it was decided to discontinue production and devote all energies to the completion of the plant for mechanical production and transportation. The stock in hand on December 31 last amounted to £53,175, compared with £10,965 a year previously, and doubtless this would have been realised but for the armistice, which released soda ash for commercial purposes. Moreover, their product had been subjected to a higher rate of duty in India, Japan and elsewhere because it was a raw material. This difficulty would be removed when the company was producing soda ash which should eventuate in the spring of 1920. No compensation had yet been received from the Government in respect of the commandeering of the company's railway and water supply in East Africa, nor for the rent of the works at Irlam, near Manchester, but the claims were still being pressed.

Although the progress of the works in East Africa had been disappointingly slow, he could assure the shareholders that they were in sight of success; meanwhile existing contracts should bring in sufficient to pay expenses. It would be possible to sell soda ash and other products at a price which would defy competition. The production and sale of granular soda were undertaken as a temporary expedient. In conclusion, Mr. Samuel stated that in due course they would certainly be shipping soda ash to the United Kingdom, and they would be able to join issue with the monopoly at present in existence in any possible attacks it might make upon their customers in various parts of the world.

The report states that the caustic soda plant was brought to the productive stage at the end of last year, and that the product is of the highest quality. The company was originally capitalised at £1,312,500, of which £1,250,000 was in ordinary and the remainder in deferred shares. When the issue was made, in July last, of £500,000 debentures, convertible into ordinary shares up to July, 1939, the capital was increased by a further £500,000.

CALICO PRINTERS' ASSOCIATION, LTD.

Mr. Lennox B. Lee, chairman of the company, addressed the twentieth ordinary general meeting at Manchester on September 17.

As no agreement has yet been reached with the Revenue authorities on the question of excess profits duty, a report and the accounts for the year ended June 30 last have not been issued. Among the points at issue is the claim made by the Association that the expenses of restoring machinery are a legitimate charge against profits during the war period. Owing to the calling up of skilled men for Government service, it was not possible to execute repairs as they were needed, with the result that machinery suffered out of all proportion to the saving in wages effected. Another unsettled question is the treatment of stocks at the end of the period of taxation. A White Paper issued in 1917 provided for a period of two years after the termination of the tax in which losses arising from the realisation of stocks in hand should be met to some extent out of the excess profits earned during the period of the tax. There is no indication at present as to how the Government intends to fulfil this promise.

With the signing of the armistice the trade, which had been steadily diminishing, nearly ceased completely, but before the end of the financial year business had revived and during the past three months has been very good indeed. In spite of very high prices there is every probability of the demand continuing. Costs of production are increasing to such an extent that further advances in selling rates will be necessary. The shortage of colours is still acute. "We recognise the progress made by British manufacturers, and though we utilise their products whenever we can, we are still largely dependent upon Swiss supplies, which are insufficient in quantity and range to meet our needs. It is obvious therefore that advantage must now be taken to obtain a share of the stocks and output of German colour secured to the Reparation Committee of the Allies under the Treaty of Peace. All the European countries except Great Britain have obtained colour from Germany, and America is sending a special commissioner to Europe on an urgent mission in order to secure a six months' supply to meet her requirements."

The company's works and mill in France have had a satisfactory year. Trade in France has revived since March last. In June, however, the works were closed owing to a general strike in the Rouen district, and at present only about half of the printing machines is working owing to shortage of coal. The recent addition of 6s. per ton to the price in this country adds £120,000 to the Association's yearly coal bill. About ten tons of coal is consumed for every ton of cloth treated.

LAWES CHEMICAL MANURE CO., LTD.

The 45th, 46th, and 47th ordinary general meetings were held in London on September 25, Mr. E. G. Cubitt presiding.

Dealing first with the accounts, the chairman said that a settlement had been finally reached with regard to the company's liability for excess profits duty up to June, 1918. During the three years the debenture debt of £6,000 had been cleared off, and £25,300 allocated to depreciation. The contingent fund now stands at £38,000, a sum which is none too large in view of the necessity for effecting repairs and renewals which could not be undertaken during the war period. The available balance at June 30 last stood at £30,929, out of which the preference dividend of 7 per cent. will be paid, and also a dividend of 10s. per share on the ordinary shares (£10), together with a bonus on the latter of 2s. 6d. per share, leaving £9,512 to be carried forward. No further dividends in respect of the two previous years are recommended. The issued capital is £328,680.

The difficulty of obtaining adequate supplies of raw materials still remains. The output of phosphate in North Africa is still abnormally low, and the French Government is retaining a larger proportion for its own consumption. There is a scarcity of shipping to convey phosphate from America, the fertiliser trade not having succeeded in inducing the Shipping Controller to provide the necessary tonnage, in spite of the circumstance that its arrival in London would not increase the congestion at the docks. The

curtailment has seriously handicapped the export trade. The accounts for the three years ended June 30 were adopted unanimously.

ASSOCIATED PORTLAND CEMENT MANUFACTURERS (1900), LTD.

The twentieth ordinary general meeting was held in London on October 3. The chairman, Brigadier-General F. C. Stanley, in his address, referred to the closer working arrangement with the British Portland Cement Manufacturers, Ltd., in which the company holds a controlling interest. For some years past the possibility of erecting cement works in India had been under consideration, and a definite scheme to effect this proposal was now being proceeded with. The rest of the address was mainly a recapitulation of General Stanley's speech to the associated company (this J., 1919, 357 R).

The financial year ended June, 1919, was the best in the company's history. The trading profit was £564,400 and the net profit £312,400. The sum of £276,200 is allocated to depreciation, renewals, etc., the two years' arrears of interest on the preference shares are now to be paid off and a dividend of 16½ per cent. (5½ per cent. in the previous year) distributed on the ordinary shares, leaving £125,673 to be carried forward.

At an extraordinary meeting held subsequently, resolutions were passed changing the name of the company to "The Associated Portland Cement Manufacturers, Ltd.," and authorising the division of the existing £10 shares into ten shares of £1 each.

Sale of the Soap Interests of Brunner, Mond and Co. to Lever Brothers, Ltd.—In a circular to the shareholders, the directors of Brunner, Mond and Co., Ltd., announce the conclusion of an agreement with Lever Bros., Ltd., whereby the latter firm will purchase for cash the ordinary shares in Joseph Crosfield and Sons, soapmakers, Warrington, and in William Gossage and Sons, soapmakers, of Widnes, which were acquired by Brunner, Mond and Co. in 1911.

The United Alkali Co., Ltd.—Arrangements have been completed for transferring the works of this company at Flint, North Wales, to Messrs. Courtaulds, Ltd.

English Oilfields, Ltd.—Dr. Forbes Leslie has informed the *Financial Times* that a seam of torbanite, 1 ft. 8 in. thick, has been struck in the company's ground in Norfolk, yielding 95 to 100 gallons of oil per ton (see this J., 1919, 337 R).

Price's Patent Candle Co., Ltd.—An offer has been made by Lord Leverhulme to purchase the entire shares of this company in exchange for shares in Lever Bros., Ltd. The price involves the payment of £1,500,000 in cash and £1,270,000 in shares. It is proposed to preserve the identity of Price's Candle Co., and to retain its present directorate and management, those directors who may desire to retire receiving compensation.

Buxton Lime Firms Co., Ltd.—The report for the year ended June 30 last states that the net profit is £33,439, after providing for debenture interest and writing off £20,649. The dividend for the year is 5¼ per cent., and £24,132 is carried forward. The dividend for the previous year was 6 per cent., with a bonus of 2 per cent. (Issued capital, £467,780; debentures, £155,600.)

John Lysaght, Ltd.—At the meeting of this company, on September 30, the chairman referred to the branch works for sheet-rolling and galvanising established at Newcastle, N.S.W., in close proximity to the steel works of the British Broken Hill Proprietary Co. The new works will be in operation during the coming year, and if the plant in course of erection proves a success, the question of further expansion will be considered forthwith. In view of the bonus received from the Australian Government, the benefit of the tariff and the advantage as regards freight, it is anticipated that the policy of local manufacture will prove a great success.

Yorkshire Dyeware and Chemical Co., Ltd.—For the year ending June 30, 1919, the company secured a record net profit of £55,600, after deducting debenture interest. The ordinary dividend is maintained at 35 per cent., £35,000 is placed to reserves and £8,700 carried forward. Stocks are £26,400 lower at £173,000. The war period has been one of great prosperity for this company, and it has now been decided to capitalise £75,000 from the reserve fund. The capital is being raised from £75,000 to £150,000 by the creation of 100,000 new shares of 15s. each, which will be distributed among the shareholders on a share for share basis. Resolutions embodying these proposals were passed at the annual meeting, and confirmed at an extraordinary meeting, both held on September 30 last.

New Issues.—*The English Margarine Works (1919), Ltd.*, has been formed, with a capital of £1,500,000, to take over the English Margarine Works at Liverpool, hitherto managed as a branch of Lovell and Christmas, Ltd. These works have a capacity of 1000 tons per week, and it is also intended to purchase the margarine business of the United Creameries, Ltd., in Wigtonshire, Scotland. The capital is divided into 750,000 7 per cent. cumulative preference shares and 750,000 ordinary shares, all of £1 each. The purchase money of £310,164 is payable in ordinary shares, and the public issue of 500,000 preference shares has been oversubscribed.

The South African Carbide and By-Products Co., Ltd., has been formed, with a capital of £307,500, divided into 300,000 7 per cent. cumulative participating preference shares of £1 (income tax free up to 6s. in the £), and 150,000 ordinary shares of 1s. each. The whole of the preference shares is now offered to public subscription. The company is promoted by the Chemico Electro Co., Ltd., to manufacture calcium carbide and to extract motor spirit, tar oil, etc., from coal and shale at Ballengeich Collieries, Natal. A factory is to be erected near the collieries, which are situated on the main line between Johannesburg and Durban, at an estimated cost of £252,500, and a contract has been entered into to provide for a supply of 1000 tons per week of fine coal at 2s. per ton.

TRADE NOTES.

BRITISH.

Imports and Exports of Chemicals.—The "Annual Statement of the Trade of the United Kingdom with Foreign Countries and British Possessions," Vol. I., 1918, has been issued by the Board of Trade [Cmd. 342, 7s. net]. Included in this bluebook are the values, and in some cases the quantities, of the chemicals etc. imported and exported during each of the five years from 1914 to 1918. The heading "Unenumerated" is still conspicuous in these returns; thus of the total dyestuffs imported last year, 60 per cent. is unenumerated; also imported potash compounds are classified into nitrate of potash and "Other Sorts," and are entered by value only.

The total value of imported chemicals, not liable to duty, and exclusive of drugs, dyes, and manures, was £25,623,731 in 1918, compared with £14,178,199 in 1917, and £4,180,400 in 1914. Im-

ports of drugs, containing no dutiable ingredient, were valued at £3,500,056 in 1918, against £2,151,600 in 1914; dyestuffs, exclusive of tanning materials and dye woods, £3,607,516 in 1918, against £2,053,961 in 1914; and manures 465,819 tons valued at £1,953,442 in 1918, and 664,735 tons worth £1,297,214 in 1914.

The values of the chemicals and chemical preparations, other than manures and medicines, exported in 1918 and 1914 were £17,288,713 and £9,356,155 respectively. Exported manures were valued at £921,019 in 1918, and £4,886,474 in 1914; and medicines £2,562,711 in 1918 and £1,968,720 in 1914.

The Dyestuffs Licensing System and the Disposal of German Dyes.—In reply to criticism advanced by the British Chemical Trades Association that the Dye Trade and Licensing Sub-Committee set up by the Board of Trade is not fairly representative of manufacturing and consumers' interests, and that merchants' interests are entirely unrepresented upon it, the Board of Trade states that representation on that Committee cannot be increased. The Association has been given to understand that the Government will take the opinion of various bodies before formulating any definite policy with regard to the disposal of German dyes received in part payment of the war indemnity. The Association suggests that re-exportation of a proportion of the dyes at attractive prices would in some respects be beneficial to trade, and it points out that between 50 and 60 per cent. of the dyes imported into this country before the war was re-exported in the form of finished goods. While recognising that opposition to speculative trading in dyestuffs in recent years is reasonable, the Association submits that the legitimate merchant, by reason of his special organisation and trade knowledge, is a useful factor, and suggests that the dyestuffs in question should be sold in an absolutely open market in small lots, preferably by a Government Department, with expert assistance on the trade and technical side. If this suggestion is unacceptable, the Association, as representing merchants generally, is prepared to undertake the sale on a basis of actual out-of-pocket expenses, with a guarantee that such expenses shall not exceed a certain specified percentage. In any case, should any firm be appointed sole distributing agent on behalf of the Government, it is understood that such firm will not be allowed to sell to one firm and refuse supplies to another at its discretion.

The Gold Coast in 1917.—The total value of imports into this colony during 1917 was £3,386,480, a decrease of £2,613,269, or 43 per cent., as compared with 1916. This decrease was due almost entirely to the difficulty of procuring goods and the lack of tonnage to convey them. The imports of coal and petroleum increased in value by 51 and 56 per cent. respectively, although the quantity of coal imported in 1917 was less than in the previous year. The United Kingdom supplied 69 per cent. and the United States 22 per cent. of the total imports.

The value of the commercial exports from the colony during 1917, exclusive of gold and specie, was £3,810,586, a decrease of £564,680, or 13 per cent. of the corresponding value for 1916; 65 per cent. of these went to the United Kingdom, 12 per cent. to France, and 18 per cent. to the United States. The following table gives the quantities and values of some of the principal articles exported in 1917:—

Cocoa ....tons	90,964	£3,146,851
Kola nuts ....lb.	11,984,645	£239,134
Copra ....tons	736	£19,916
Auriferous by-products lb.	37,501	£22,316
Palm kernels ....tons	4,768	£74,911
Palm oil ....galls.	198,900	£24,770
Rubber ....lb.	2,961,204	£110,272

The rubber exported increased in value by £31,407, or 40 per cent., and was four times that exported in 1915. This boom was due to better prices and greater demand from Great Britain, and resulted in a better quality of rubber being obtained by the natives, who took more care in its collection and preparation for sale. The copra industry is being developed in the Quittah district. The exports of cocoa show a decrease of 18 per cent. in value, but an increase of 26 per cent. in quantity. Ships have been compelled to give preference to freights of palm oil, palm kernels and ground nuts.

Experiments on the extraction of cocoa butter have been carried out at Aburi. Extraction by primitive means gave a yield of 17 per cent. from unfermented beans. The matter is being taken up by the Agricultural Department, on account of the abnormal depression in the local cocoa market.

The mining of manganese ore in the Dagwin Concession has already been referred to in these columns (this J., 1918, 57 R, 458 R; 1919, 319 R).—(*Col. Rep.-Ann.* No. 988, *Aug.*, 1919.)

FOREIGN.

The Rubber Industry of Japan.—The satisfactory progress made by the Japanese rubber manufacturers during the period of the war will be evident from the figures in the following tables. Judging from the import of crude rubber, which has more than doubled during the three years under review, the annual value of the output of manufactured rubber goods in Japan at the present time probably exceeds six million pounds sterling. In particular notable progress appears to have been made in the cable industry, which has displaced cycle tyres from the first position on the export list of manufactured rubber goods. In connexion with an important contract for sheet and hose to be placed by a foreign Government, the four rubber factories in Tokyo have come to a working agreement regarding the quality to be supplied, and this action is thought by the trade to foreshadow an amalgamation which should greatly strengthen the position of the Japanese rubber industry.

IMPORTS.

Article.	1918.		1917.		1916.	
	Quantity.	Value. (£).	Quantity.	Value. (£).	Quantity.	Value. (£).
		£		£		£
Crude rubber	5,761*	1,094,756	3,043*	753,114	2,567*	637,189
Automobiles..	1,483	369,414	733	130,761	167	35,123
do. Fittings	—	243,696	—	94,627	—	29,884
Bicycles ..	1,203	25,290	843	11,871	1,176	7,951
Tyres ..	378	105	2,063	533	5,353	1,999
Belting ..	—	38,768	—	28,190	—	20,753
Insulated cables	—	665	—	—	—	129,466
Waterproof cloth ..	—	1,272	—	2,439	—	2,489
Elastic bands	—	30,189	—	2,153	—	25,826
Insulating tape	—	2,385	—	2,626	—	2,727
Dental rubber	—	8,874	—	9,108	—	9,906
Sheet & hose..	—	27,624	—	14,331	—	12,562
Toys	—	5,401	—	3,737	—	3,164

*Tons.

EXPORTS.

Article.	1918.		1917.		1916.	
	Quantity	Value. (£)	Quantity	Value. (£)	Quantity	Value. (£)
Rickshaws	2,407	12,776	6,395	26,760	8,044	29,235
Bicycles ..	6,146	27,132	4,855	15,418	—	—
Tyres ..	2,061,636	383,042	2,008,237	376,778	1,939,008	381,068
Insulated cables ..	—	658,156	—	280,755	—	101,640
Miscellaneous	—	99,391	—	52,972	—	—

REVIEWS.

ÉTUDES DE PHOTOCHIMIE. *Par* VICTOR HENRI. *Pp. vii. + 218. (Paris: Gauthier-Villars et Cie.,* 1919.) *Price* 18 *francs* + 20%.

This book is the first of a short series of monographs which Prof. Henri hopes to publish in the near future. This volume makes a real contribution to the literature of physical chemistry, and contains a fascinating account of the work of a man of great reputation in the field of absorption spectra and photochemistry. It engenders also ceeded in inducing the Shipping Controller to volumes.

In his preface the author explains how he was invited in the early days of the war to take up important work in Russia, and how the greater part of the writing has been done in Moscow and Petrograd. It is possible that to this cause is due a somewhat striking want of reference to work carried out in other cities than Paris. It may be that the extraordinary history of Russia during the last three years has caused the author introspectively to discuss the researches carried out by himself and his colleagues without realising that the laws he enunciates as new had already been published. Various statements made in the course of the book would lead to the belief that the author has not had full opportunity of consulting the work of other experimenters that has been published during the last three or four years. In the case of most books this would be a damning criticism, but it must be remembered that recently the study of absorption spectra has gained a much broader outlook. The quantitative relations enunciated by the author between the frequencies exhibited by substances in the infra-red and ultra-violet regions have opened out a new vista, and while not original they have been independently and amply confirmed. To all who read this book it will be obvious that the chapters have been written at different times with perhaps long periods of time intervening between them. This fact, taken in conjunction with the author's experiences in Russia, will justify our ignoring the above criticism, and the unmentioned authors will surely concur in this.

It is interesting to note that Prof. Henri has entirely treated the subject from the point of view of classical mechanics. Now there is little doubt that the energy quantum theory meets with its greatest success in its application to the phenomena of absorption of radiant energy, and yet this theory only finds scant mention from Henri's pen. This is not the place to discuss the arguments for and against this theory, but when it is remembered that the stabilisation of this theory is so intimately bound up with the quantitative measurements of the absorption and radiation of energy some regret must be felt that no attempt is made to discuss it. Its conception was a real contribution to scientific thought, and it cannot be ignored. One is tempted to believe that this omission is due to the fact that about six years ago Henri and Wurmser published some results which apparently contradicted one of the laws derived from the theory, namely, Einstein's photochemical law. If so, this is unfortunate, since it is highly probable that the contradiction is not a real one, but arose from a want of consideration of the whole photochemical process, as pointed out by Trautz and others. Further, it is unscientific to belaud or condemn any theory which is based only on a single set of unconfirmed observations. To anyone who seeks unbiased after truth it may be said that the quantitative results published by Prof. Henri seem to afford the best evidence yet found in favour of the quantum theory. Further, it would seem that the theoretical conceptions given by the author are at times a little strained, and do not always agree with observations that have been recently published.

Apart from these criticisms the book is admirable. Like every book from the pen of a French scientist, it is thoroughly well written, clear and lucid. It is divided into three sections, the first dealing with the experimental methods. In the second section the author shows how it is possible to calculate the absorption curve of one substance from those of other analogous substances, while in the last section the question of molecular constitution is discussed. The number of observations made by the author and his colleagues is very large. The infra-red and ultra-violet absorption, together with the dispersion, of over 230 substances have been accurately measured. The material on which the author bases his calculations is thus very extensive, and it embraces examples drawn from all the principal classes of organic compounds.

The results given in the chapters dealing with the calculation of absorption bands are peculiarly interesting, for they afford very clear evidence of the extent of the new developments in absorption spectra observations. Apart from the great accuracy necessarily inherent to such measurements, these calculations establish more definitely the remarkably intimate connexion which exists between the molecular frequencies possessed by a substance in the very long wave and very short wave regions of the spectrum. The support given to the arguments first advanced by Lord Rayleigh and by Bjerrum in this connexion is exceedingly strong. They, moreover, confirm very clearly some previous observations that molecular frequencies are directly derived from frequencies which are characteristic of atoms and groups of atoms.

This most attractive book can be strongly recommended to all interested in the modern physical developments of chemistry; it will not only serve to correct some wrong impressions which have gained currency in respect of past work, but will indicate the great possibilities of future research in this field of absorption spectra and photochemistry.

E. C. C. BALY.

PUBLICATIONS RECEIVED.

AN INTRODUCTION TO THEORETICAL AND APPLIED COLLOID CHEMISTRY. ("THE WORLD OF NEGLECTED DIMENSIONS.") *By* WOLFGANG OSTWALD. *Translated by* M. H. FISCHER. *Pp.* 232. (*New York: John Wiley and Sons, Inc. London: Chapman and Hall, Ltd.* 1917.) *Price* 11*s*. 6*d*.

CATALYSIS IN THEORY AND PRACTICE. *By* E. K. RIDEAL *and* H. S. TAYLOR. *Pp.* 496. (*London: Macmillan and Co., Ltd.* 1919.) *Price* 17*s*.

THE CHEMISTRY OF COLLOIDS. *Part I., Kolloidchemie. By* R. ZSIGMONDY. *Translated by* E. B. SPEAR. *Part II., Industrial Colloidal Chemistry. By* E. B. SPEAR. *A Chapter on Colloidal Chemistry and Sanitation. By* J. F. NORTON. *Pp.* 288. (*New York: John Wiley and Sons, Inc. London: Chapman and Hall, Ltd.* 1917.) *Price* 13*s*. 6*d*.

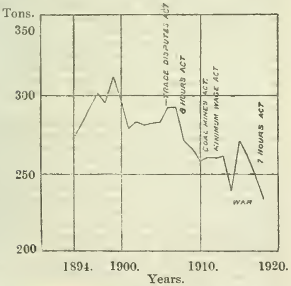
COMMERCIAL OILS, VEGETABLE AND ANIMAL. *With special reference to Oriental Oils. By* I. F. LAUCKS. *Pp.* 138. (*New York: John Wiley and Sons, Inc. London: Chapman and Hall, Ltd.* 1919.) *Price* 6*s*.

CHEMICAL CALCULATION TABLES. *For Laboratory Use. By* H. L. WELLS. *Second edition, revised with a Double Thumb-Indexed Logarithm Table. Pp.* 43. (*New York: John Wiley and Sons, Inc. London: Chapman and Hall, Ltd.* 1919.) *Price* 6*s*. 6*d*.

FUEL ECONOMY.

There has been no subject amongst all the varied issues involved in post-war reconstruction which has been more extensively discussed than that of fuel economy, and there is probably none of more importance to the entire community. It must not, however, be assumed that this, though an urgent post-war problem, owes its origin entirely to the war. For many years we in this country had the advantage of a cheap and abundant coal supply, and as a natural consequence of this state of affairs we made a most wasteful use of this important product. Gradually, as the seams of coal that were most easily and most cheaply won were to a large extent exhausted, and it became necessary to draw upon thinner and deeper seams for our supplies, our superiority in natural advantages became less marked, though the effect was to a great extent masked by the introduction of mechanical appliances and the improvement in our methods of coal getting. The decrease in the production of coal per worker is shown by the following graph, which shows a constant downward tendency since 1899, although it has been most marked since 1915. Of course there are fluctuations depending on the state of trade and conditions of the markets, but none of these can account for the steady fall in recent years, which has been so serious that the output per man per annum is to-day only two-thirds of what it was twenty years ago.

Output of Coal in Tons per Surface and Underground Worker.



The natural decrease above referred to has been immensely intensified by a succession of legislative enactments which have gradually tended to remove the coalminer's incentive to work; the effect of the Eight Hours Act (1908), and still more of the Minimum Wage Act (1912), has been most marked, so that the country is now faced with the serious situation that our supply of coal will not only be very much dearer, but will also be very much less than it has been in earlier days. The increase in cost is the less grave danger of the two, but the probability that the country's output of coal will fall below the country's needs, if we are to maintain a sufficient volume of exports to pay for the necessaries of life that we have to import, is a danger the magnitude of which can hardly be over-rated. It is this pressing danger that renders the problem of Fuel Economy one of such great national importance, and it is small wonder that it has formed the subject matter of reference to numerous Government Committees and Commissions and that both the British Association and the Iron and Steel Institute have discussed it at length within the last few weeks. In spite of the immense amount of attention that has thus been devoted to Fuel Economy, it is a curious fact that no one has yet defined precisely what is meant by the phrase. It can, however, be interpreted in quite a number of different ways; in the first place, a broad distinction must be drawn between what may be called thermal economy and commercial economy. Taking the case of a works requiring large quantities of steam both for power and for heating purposes, it is quite obvious that it would in probably every case be possible to decrease its weekly coal consumption by putting in the very best types of boilers and engines, and by utilising to the utmost every portion of "waste" heat. In this way the works could be carried on by the initial expenditure of fewer heat units—that is to say, by the consumption of a smaller tonnage of coal, and this would be a case of thermal economy. It might well be, however, that the money value of the coal so saved would be considerably less than the interest on the capital required to make the necessary alterations, taking, of course, due account of the depreciation of the new plant thus installed, and if this were the case, the alteration, though thermally economical, would become commercially wasteful. Again, it might be possible actually to increase the coal consumption, and to recover a large number of valuable by-products, the sale of which would bring in an annual sum of money greater than the cost of the additional coal; under these conditions commercial economy might be attained at the cost of thermal extravagance. Suppose, however, that the by-products included such substances as fuel oils, the thermal value of which is greater than that of the additional coal consumption, the total fuel economy might be increased, though the fuel consumption in the works themselves might be greater. The subject is therefore an extremely complex one, and disregard of any of the multifarious conditions is apt to lead to false conclusions. For example, the Final Report of the Coal Conservation Sub-Committee of the Reconstruction Committee advises the erection of large central "super-plants" for the generation of electric power, which would then be distributed from these central plants to users, on the ground that greater economy in the consumption of the coal used to generate the electric power would result, whilst it would also be possible to extract the valuable by-products of the coal. This is quite true as far as it goes, but no account appears to have been taken of the coal lost in transmitting the electric current from the central station. Assume for the sake of argument that a "super-plant" is erected and that electric current is required 50 miles away from it. It is doubtful whether in practice electric current could be transmitted 50 miles with a smaller loss in leakage, resistance, etc., than 10 per cent., so that if 1000 tons of coal were used in generating electric current, only the equivalent of 900 tons of coal would be delivered at the point where the power was required. If, on the other hand, the coal were carried 50 miles by train and converted into electric current at the spot where it is required, the locomotive hauling the train would not burn more than three tons of coal, so that 997 tons of coal would be available for the generation of electricity. Even allowing for the possible economies of very large as against medium-sized plants, it is obvious that the "super-plant" would not economise coal, but quite the reverse, in spite of the contentions

of the Coal Conservation Sub-Committee. Although thermal economy would thus not be attained, there might be savings in other directions, and it is quite possible that commercial economy might result. The question that probably should be looked upon as the most important in this connexion is, "Which form of fuel economy is best for the nation as a whole?" It is not suggested that this question admits of any simple definite answer, and indeed it has already been shown that the data available are not likely to allow of any ready generalisation, whilst their complexity renders it highly probable that each special case will require individual consideration. All that it is desired to do here is to direct attention to the fact that the problem is a highly complex one, that there are a large number of factors, many of them necessarily conflicting, that must be taken into consideration, and that any attempt to find a legislative solution to be applied indiscriminately to the entire country is bound to be attended with failure, and may very easily be productive of more harm than good.

RECOVERY OF NITRE AND PITCH FROM "SMOKE CANDLES."*

E. R. THOMAS.

Among the various duties of an ammunition officer in the field is that of the disposal of dangerous and unserviceable ammunition, the latter being, as a rule, considered unsafe for storage.

Those stores such as "Ground Flares" (consisting of shellac and nitrates) and "Smoke Candles" (pitch and potassium nitrate) which depend for their efficiency on the dryness of the priming composition used for their ignition, are particularly liable to deterioration on exposure, and large quantities are found on examination to be unserviceable.

The author was horrified to find that the unserviceable flares and smoke candles were being burnt or dumped in the English Channel with a considerable expenditure of time and labour. Although he had been advised to conceal his knowledge of chemistry—advice not without its point—he set out to find some simple method for recovery of the pitch and potassium nitrate from the smoke candles. This was soon elaborated, and, with the aid of a band of Chinese coolies, over a ton of pitch and nearly a ton of potassium nitrate were produced daily.

The methods were crude. The extraction was done in Soyer stoves, and the crystallisation in unserviceable cartridge cylinders. The stirrer was part of a broken ammunition box, and the fuel was waste wood from the same source. After all expenses were met, the work resulted in a profit of at least £20 a day, while at the same time avoiding the expense involved in the destruction of the stores.

The pitch was mixed with sand and used as a substitute for timber for flooring purposes. The work was also carried out at two convalescent camps where the labour cost was nil. In both places very large "Physical Training Huts" were completely floored with material from the recovered pitch. The potassium nitrate was stored and ultimately returned to England.

The success of these operations led to their authorisation and extension to many classes of unserviceable ammunition previously dumped in the Channel.

* From a paper entitled "An Ammunition Chemist in the Field," read before Section B of the British Association for the Advancement of Science, Sept., 1919.

GLASS MANUFACTURE AT THE END OF THE WAR.*

MORRIS W. TRAVERS.

During the war many British glass factories were engaged to a very considerable extent in producing goods and materials which had previously been partly or wholly imported from enemy countries, but which were equally indispensable in war or peace. Plant and labour were diverted to these special purposes; and some branches of the industry in which the country had already secured a predominant position suffered severely, other branches developed, and entirely new branches of the industry were established. In common with all other industries, the glass trade suffered severely from shortage of labour and material, and particularly owing to the fact that as soon as the lads became sufficiently highly trained to be really useful workmen they were often called up for military service. Furnaces and plant had been worked beyond the economic limit, and were badly in need of repair before the signing of the armistice made it no longer necessary to carry on at all costs. The fact that much of the new constructional work carried out during the war was essentially of an emergency character, carried out with war materials and at war costs, has also to be considered when reviewing the position at the end of the war.

The British glass trade may well be proud of the part which it has played in the war; but there is no little danger that while we continue to celebrate our victories, we may lose the opportunity of consolidating our position. Any scheme devised for the safeguarding of the industry can only be effective if the industry strain every effort to attain to the highest pitch of efficiency; for we may be certain that our late enemies will also strain every effort to win back the positions which they formerly held. They have still their factories, generally in good working order, much of their trained labour and management, and above all a great store of knowledge and experience.

Circumstances arising out of the war have done much to dissipate the idea that success in industry depends upon the possession of trade secrets. The Society of Glass Technology and the new trade associations have already done much to bring manufacturers together, and to promote the spirit of co-operation. Such research as has been carried out during the war has aimed rather at the solution of problems arising out of the need for producing goods previously imported from enemy countries, and it is difficult to lay one's hand on a really original discovery in connexion with glass. However, the lines which future investigations must follow are fairly well defined.

The difficulties attending the scientific investigation of glass are extraordinary. We have as yet no knowledge of the nature of glass, and experimental methods have yet to be developed. Glass is often vaguely referred to as "a super-cooled liquid rather than a solid," and sometimes as a "colloid." Certain opaline and coloured glasses certainly contain ultramicroscopic particles; but though there is reason to believe that the complex technical glasses are not simple super-cooled liquids, positive information as to their true character is lacking. Vague speculation in the absence of facts is unprofitable.

The difficulty of investigating the properties of technical glasses is enhanced by the fact that, unless

* Communicated by Section B (Chemistry) of the British Association for the Advancement of Science. Abridged.

the precautions taken in the manufacture of optical glass are observed, different samples of glass from the same pot may vary materially in composition. Technical glasses often, if not usually, actually represent unstable systems. That it is difficult to find any close relationship between the composition and properties of technical glasses is not, therefore, to be wondered at. At the outbreak of war the independent workers who undertook the investigation of glass must have been struck with the paucity of journal and text-book literature on the subject, and with the fact that such literature as existed contained no practical details and few analyses. In the case of miners' lamp glasses official tests were established, and the requirements of the makers of lenses, etc., were definitely known. It appeared, however, that few chemists ever tested the glassware they used in their laboratories; the results of a few tests had been published, but as to which of the various brands was really the best was rather a matter of opinion, or even of prejudice, than of scientific proof.

It is generally recognised that, at a comparatively early stage in the war, British manufacturers succeeded in producing glasses for many essential purposes which compared very favourably with the foreign goods, but it will be unfortunate if they fail to realise that there is yet scope for improvement. No resistance glass for chemical glassware has yet been discovered which is sufficiently highly resistant to all ordinary reagents to be considered to be an approach to perfection. It must be admitted that the lamp workers (workers at the table blowpipe) have reason to be highly dissatisfied with the general quality of the tube with which they have had to work. Difficulty of obtaining materials has certainly been a handicap to the manufacturer. However, it is a fact that, while a first-class lamp-working glass must be soft, and must have a low melting point, these glasses "plain" (free themselves from seeds or bubbles) only when very strongly heated in the furnace. The poor quality of much of the tube manufactured in this country is due to the fact that the furnaces are not capable of working at high enough temperatures.

Almost nothing is known of the chemistry and physics of the founding and plaining of glass, exactly why it is, for instance, that a "checked" pot of metal will not "plain," or how and why the various kinds of cords are formed. We have very little quantitative knowledge of the properties of plastic and liquid glass, and very few attempts have been made to work out methods of investigation. Glass has, of course, no melting point, but perhaps the point of cohesion of two pieces of glass in optical contact, which seems to be quite sharp, may serve as a physical constant. The viscosity of glasses, about which nothing is known, is a matter upon which information would be of use to manufacturers who employ mechanical methods of glass blowing.

There is considerable scope for investigations on the materials used in the glass trade, particularly with a view to substituting cheaper materials for those in use before the war. The best quality of resistance lighting ware manufactured in Austria before the war contained a large proportion of boric acid, which would make the goods almost prohibitively expensive at the present price of borax. A good deal has been done during the war in the way of substituting soda for potash in glasses, but the results, at least so far as glass or electric lamp bulbs and lamp-working tube are concerned, have not proved satisfactory. However, systematic research may be fruitful of results. The influence of ingredients of glasses, such as magnesia and alumina, which have generally been introduced into glasses accidentally as impurities in the raw materials, is a subject for research.

Prof. Boswell and others have carried out useful investigations on British sources of important glass-making materials, such as sand and felspar, but the results have not been highly satisfactory, possibly partly owing to circumstances arising out of the war. In 1915 it was still possible to obtain Swedish felspar containing 13 per cent. of potash and very little iron, delivered flour-ground in London at less than £3 per ton. During the present year the cost of Cornish felspar, containing 10 per cent. of potash and a considerable amount of iron, delivered in lumps in London, cost over £7 per ton. The difference in the quality of the material is even more important than the increase in price.

Except in some of the larger works, very crude methods are employed in the handling and treatment of materials, and in this the glass trade may be considered to be very backward. The best methods of grinding and mixing batch and cullet, and the use of magnetic separators, conveyors, etc., in the industry really require investigation. The treatment of different kinds of material requires special study. On the proper treatment of the materials and the mixing of the batch depends the quality of the glass, and the saving of loss due to stones and cords. Glassmakers are hard on machinery, which they cordially dislike, but which they will have to put up with if the trade is to hold its own against foreign competition.

Success or failure in every branch of the industry depends in a great measure on the efficiency and economy with which the "metal," or molten glass, can be produced. Furnace problems therefore rank high in importance, and first among them come those which relate to the manufacture and treatment of refractory materials. Refractories in the glass industry have to withstand not only the high temperatures, but also the fluxing action of glass, and must therefore be studied from the particular standpoint of the industry.

Regenerative or recuperative gas-fired pot furnaces have for some time been in use in this country, but recent attempts to work them intensively have not met with a great measure of success on account of the repeated failure of the refractory materials in the furnaces and pots. When working at full pressure, and using open pots, it is possible to fill the pots after the blowers have stopped work in the evening, and to found, plain, and cool off the metal by the next morning. Thus it is possible to work the factory with a single shift of blowers working about 48 hours a week. However, to work this single shift the glass must be got ready within the twelve hours.

Continental glass manufacturers have succeeded in working in this way, and for the sole reason that they are provided with superior refractory materials. It appears that satisfactory fire-clays exist in this country, and the production from them of suitable fire bricks, siege blocks, pots, etc., should not present insuperable difficulties. The problems await the early attention of the Glass Research Association. The matter is one of vital importance, for the saving of fuel alone is 50 per cent. of that used in the non-regenerative furnaces.

The position with regard to tank furnaces is more satisfactory, but much may be done towards the improvement of the refractories used in their construction. The increase in the cost of fuel and labour also calls for close attention to improvements in gas producers and mechanical accessories.

During the war considerable progress was made in the manufacture of mould-blown goods, such as electric lamp bulbs, and scientific and illuminating hollow ware, which differ from common bottles in that the goods show no seam, the glass being turned in the mould during the process of blowing. Mould-blown goods cannot be classed as artistic, but from

the utilitarian standpoint they are often superior to the hand-made, being consistently true to pattern, and much the cheaper.

Progress in the application of mechanical methods to the production of this class of goods has been made only to the extent of introducing American machines, such as the Empire machine and the Westlake machine, which two British firms have installed for the manufacture of electric lamp bulbs.

Progress in the manufacture of jars, bottles, etc., from glass produced in tanks has been retarded rather than advanced by the war, but manufacturers seem anxious to make up for lost time. It must be admitted that more actual progress is being made in America than in this country, and there is a tendency on the part of our manufacturers rather to purchase the rights to use American machinery than to spend money on the investigation and development of new processes. Enterprise of this kind is very costly, and more than one American invention is credited with having cost those who undertook the development of it more than half a million sterling.

The output of glass tubing has been enormously increased, particularly for uses connected with the war. In many glasshouses men engaged in the hand-made trade became tube drawers, and soon became highly skilled at the work. The methods of working employed varied greatly, and it would be interesting to obtain statistical information as to their relative efficiency. It must be allowed that, as much of the tube was drawn in glasshouses not specially designed for tube drawing, the men were often at a serious disadvantage. If the output is to be large, a tube shop must be so designed that the men have to walk the minimum distance between the processes of gathering, marvering, reheating, etc. Tubes over one inch in diameter should certainly be annealed before issue, which is not usually done.

Several methods of tube drawing by machinery have recently been patented in America, but little is yet known as to their merits.

Our knowledge of the processes of annealing is not satisfactory, but it has certainly been extended during the war, and in this connexion the thanks of the glass trade are due to Mr. F. Twyman, of Messrs. Adam Hilger, Ltd., whose valuable contribution to the study of the subject has been published in the Journal of the Society of Glass Technology. The Hilger instrument for testing goods after annealing has found wide application.

The fact is that both ornamental flint glass and common bottles anneal without difficulty, the one on account of the nature of the glass, the other on account of the fact that the lehrs contain a large mass of hot material the temperature of which must naturally change slowly. However, in dealing with light articles, particularly when, as in the case of chemical or illuminating hollow ware, resistance glasses are used, considerable difficulties are experienced. The glass is first chilled in the mould so as to set up the condition arrived at in the so-called toughened glass. An unannealed beaker will stand any amount of rough treatment, and liquid may be boiled in it. However, it cannot be *cut off*, and it may at any moment fly to pieces. In such an article the outer surface is probably fairly uniformly in compression and the inner surface in tension.

The first stage in the annealing of such goods is to heat them to a temperature not far below the softening point for a sufficient time to eliminate the stresses. This is the vital part of the process, for it seems as if a badly annealed article were practically even more unstable than such an article before annealing, owing to the inequality of the strains. Very even and regular heating is necessary, and this is only attainable in specially constructed lehrs heated from below as well as from above. The cooling must be at such a rate as to avoid the introduction of fresh strains in the glass. The annealing of light hollow ware is of vital importance.

In branches of the trade in which the goods have to go through a number of processes, success or failure depends very largely upon the proper lay-out of the works, and the arrangement for transporting the goods so as to avoid breakage in passing from department to department; and very close attention will have to be paid to working conditions, to the comfort of the workpeople, and to their convenience in the matter of hours of labour. The scientific study of problems relating to industrial administration has made great progress in America, and is now receiving attention in this country.

The foregoing remarks apply to the glass industry in general, but the varied character of the numerous branches makes it quite impossible to deal with matters of detail. At the moment special interest attaches to certain branches of the industry which are scheduled for protection in accordance with the new trade policy. These are:—"Optical glass, including lenses, prisms, and like optical devices. Scientific glassware. Illuminating glassware." The country is now practically self-supporting with regard to scientific hollow ware, and it may be hoped that the labours of the Standardisation Committee of the Society of Chemical Industry, which have aimed at the standardisation of chemical apparatus, may have been of value to the industry. The output of lamp-blown apparatus and of graduated apparatus has increased enormously, but it may be anticipated that this branch of the industry will meet with keen competition. The scientific public, critical of home-made goods, has suddenly awakened to the fact that much of the imported graduated ware was very inaccurate, and is insisting on a higher quality of goods, which the British manufacturers are succeeding in supplying.

Though great progress has been made in the manufacture of illuminating glass ware, neither plant nor labour has been sufficient to cope with the demand. Optical glass was manufactured in this country before the war, but on a scale totally insufficient to meet our requirements, and during the past five years the development of the industry has been extraordinary. It must be remembered that while a very inferior lamp chimney will still serve a very useful purpose, optical glass must be good, indeed, very good, or it will be quite useless.

In this part of the industry refractories play an important part, for if the pots will not withstand the solvent action of the glass, as the pot material dissolves it changes its composition, and also gives rise to stones and cords. The iron oxide from the clay tends to discolour the glass, and the colour cannot be corrected by the use of manganese or other reagents. Stirring the molten glass, which is necessary in order to make it homogeneous, naturally presents difficulties which have been only partially overcome. The reduction of the wastage between the founding of the glass and the formation of the blocks and blanks supplied to the lens maker offers scope for investigation. Though much research work has already been carried out in this country and also in America, where the industry is also a new one, much remains to be done. Very high credit attaches to the work already accomplished.

Finally, while we must try and hold on to what we have won, we must endeavour to win back what we have lost. The diversion of plant and labour previously engaged in the manufacture of high-class ornamental glassware has resulted in the disorganisation of a branch of the industry in which

the country held a predominant position. It must be remembered that the Central Empires formed one of our best markets for this class of goods.

The replacement of hand-made articles by machine-made goods is perhaps one of the unavoidable consequences of civilisation, and, balancing the advantages and disadvantages, we may, on the whole, gain by the change. While the machine may increase the perfection of the form of the article, though perfection of form may not imply enhancement of beauty, the material almost always suffers in mechanical treatment. There is a play of the lights on the surface of a piece of hand-worked English flint glass which is never to be found in a mould-blown article. American mechanical reproductions of English cut glass are very wonderful, but they absolutely lack the craftsman's touch.

This branch of the trade should remain largely a handicraft. Economies can, however, be introduced in many directions, and there is no reason why the old-fashioned round furnace should still be used. Such fuel-wasting machines should, in the national interest, be prohibited under D.O.R.A., or her successor.

YEAST GROWTH AND ALCOHOLIC FERMENTATION BY LIVING YEAST.

ARTHUR SLATOR.

The methods used by the physical chemist to measure rates of chemical reactions can be applied to investigate the process of alcoholic fermentation by living and growing yeast cells. The results obtained in this way are valuable, for they not only give new information, but also make it possible to bring into line results obtained by other methods. In this communication yeast growth and alcoholic fermentation are considered from this point of view.

The subject matter may be explained by describing the growth of yeast cells in a nutrient medium, and by pointing out the main factors which determine the rate of growth and rate of fermentation at different stages of the reaction.

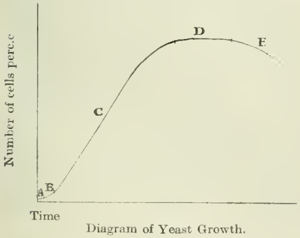


Diagram of Yeast Growth.

A—lag phase in growth; B—logarithmic phase; C=retarted growth; D=yeast crop; E=death of yeast cells.

If a trace of yeast is seeded into malt wort, which is a medium containing all foods necessary for yeast growth and also large amounts of fermentable sugars, the yeast cells bud and grow. If the number of cells is plotted against the time a curve of the type given in the diagram is obtained.

After a certain initial disturbance (lag-phase) the cells multiply regularly, the number increasing logarithmically with the time. All the usual equations employed to calculate the rate of unimolecular chemical reactions can be applied to yeast growth over this period, if note is made that the reaction is increasing in rate instead of decreasing as is the case with ordinary chemical reactions. There are several methods of measuring this logarithmic constant of growth (K) or the generation time (G.T.) which is a number inversely proportional to K. (G.T. $\times$ K. = log. 2). Some of them depend on counting yeast cells under the microscope, and others on measuring rates of fermentation from which rates of growth can be calculated.

The results show that when all necessary food is supplied in sufficient concentration yeast cells develop at a rate determined by the temperature and the race of the yeast used.

Temperature coefficients vary greatly with the temperature. At 25° C. the rate is usually about four times that at 15° C. The shortest generation time so far observed is about 1 hour. The retarding influence of carbon dioxide and alcohol, and the necessity of oxygen for yeast growth can be demonstrated and measured by these methods.

Lag-phase in growth.—If yeast cells from an old culture are introduced into fresh wort a period of quiescence is observed before budding takes place. When growth has once started it continues at the normal rate. A bakers' yeast at 30° C. gave a period of one hour before buds appeared and then all the cells, except the dead ones, budded irregularly during the next hour. Older cultures showed more dead cells but not a longer period of quiescence.

The lag-phase in the growth of bacteria has been examined by Penfold (1914) who used the method of "plating" to estimate the number present, and many important observations were made. Some of the results have been submitted to mathematical analysis by Ledingham and Penfold (1914). The matter has been further discussed (Slator, 1917), but an investigation of the lag-phase in yeast growth (1918), leads one reluctantly to the conclusion that Ledingham and Penfold's equation is not of general applicability.

There is no doubt of the interest and importance of this period of growth and yeast cells are well adapted for the purpose of further investigation.

Phase of retarded growth.—As yeast develops in malt wort the first retarding influence which comes into play is that due to carbon dioxide. Continental investigators have rightly laid stress on the preservative action of carbon dioxide; in this country the influence has been recognised, but the effect has been attributed to the exclusion of oxygen rather than to a direct poisoning effect

The retarding influence of the gas can be detected when the yeast concentration has developed to about a million cells per c.c.

Oxygen is necessary for yeast growth, and lack of oxygen soon makes itself felt and is the main retarding influence when yeast cells develop from a few million cells per c.c. to the maximum growth of about 100 million per c.c.

A. J. Brown (1905) was the first to show that arrest of cell reproduction under these conditions is due to this lack of oxygen. H. T. Brown (1914) further investigated the matter and *inter alia* obtained the important result that yeast growth increases proportionally with the amount of dissolved oxygen initially present in the wort. For

the production of 10^{10} yeast cells, 1·7 c.c. of oxygen is required.

Measurements of the logarithmic constants of growth under anaerobic and aerobic conditions have been made. In these experiments malt wort behaved as if it contained a certain amount of combined oxygen available for yeast growth. The results are not in agreement with H. T. Brown's conclusion (1914) that growth under anaerobic conditions is due entirely to oxygen previously absorbed by the yeast.

Alcohol also acts as a retarding agent, but usually growth stops in a fermenting solution before the alcohol concentration is sufficient to have much influence.

Yeast crops.—The cause of the final cessation of yeast growth in malt wort is usually lack of oxygen, but it is evidently possible to arrange conditions under which the yeast crop is determined by other limiting factors.

Lack of fermentable sugar, which also acts as a food for the yeast, may be the limiting factor which finally prevents further growth. A discussion of this typical case will show on what factors yeast crops depend.

During the logarithmic period of growth the yeast growth N during the time in which S grams of sugar disappear (by growth and fermentation) are connected with K the constant of growth and F the fermentative activity of the yeast by the equation $N/S = K/F$. During any other period of growth the relationship $\frac{dN}{dS} = \frac{K}{F}$ holds good for small increments in N and corresponding decrements in S. We have therefore $N = \int \frac{K}{F} dS$, that is, the yeast crop from a small seeding is determined by the value of the integral between the limits S = initial concentration of the sugar to S = O. The ratio K/F and its variation with different sugar concentrations determines the amount of yeast a given medium can produce. If K/F is constant (which is approximately the case, for both K and F are independent of the sugar concentration except when the solutions are dilute) the growth and the initial sugar concentration will be proportional. H. T. Brown (1914, 226) finds that 2·3 grams maltose disappear when 10^{10} yeast cells are produced.

Yeast growth may cease owing to the production of large amounts of alcohol. The crop under these conditions is determined by the way the ratio K/F varies with different concentrations of alcohol, and the same method can be used to calculate the yeast growth. The integral is in fact of general application whatever the final limiting factor is.

The ratio K/F is independent of the number of yeast cells present. It follows therefore that with a medium of given composition the total possible growth is a constant, the crop being equal to the sum of the seeding and the growth. A. L. Stern (1901), in a series of careful experiments on the point, has proved this experimentally in the case of a Burton yeast growing in a solution containing glucose, asparagin and mineral salts.

A. J. Brown's previous observation (1892) that large seedings of yeast in wort refuse to bud is contrary to this general conclusion that the increase should be the same whatever the seeding is. The non-multiplication in this case is probably due to lag in growth and the very rapid accumulation of retarding influences.

Again Stern shows that yeast crops are almost independent of the temperature of growth. The temperature coefficient of growth and that of fermentation over the range of temperature in these experiments are not equal, but approximate closely enough to account for the results obtained.

Death rates.—When yeast growth has finally ceased the cells suspended in the fermented liquid gradually perish. If the liquid is kept free from other organisms a few living yeast cells may still be found after many years' preservation. Very little information regarding death rates of yeast cells is available, but experiments with bacteria show that micro-organisms under unfavourable conditions usually perish at a logarithmic rate (H. Chick 1908, 1910).

In investigating alcoholic fermentation at high temperatures or in the presence of poisons, death rates and rates of inactivation come prominently into consideration. The process of pasteurisation, the preservation of pitching yeast and pure cultures of yeast depend on death rates which have not yet been investigated.

Growth and fermentation.—The main factors which determine the rate of fermentation during any of these periods are the number of cells present, the fermentative activity of the yeast and the temperature. The rate of fermentation is independent of the sugar concentration except in dilute solutions. Sugar concentrations, therefore, come into consideration only at the end of fermentation.

Maltose, the principal sugar in malt wort, is hydrolysed sufficiently rapidly by culture yeasts to supply adequately the yeast cell with glucose. Dextrin is not fermentable by yeast, but there exist in malt wort substances intermediate between dextrin and maltose which are hydrolysed slowly by yeast and subsequently fermented. Little is known of the rate of fermentation of such maltodextrins or how they are hydrolysed.

If living yeast is introduced into wort or into a solution of glucose, fermentation starts immediately. Quiescent yeast cells are usually rather more active than the smaller growing ones. Fermentation does not become visible until the solution is saturated with carbon dioxide, and hardly shows on a saccharometer until some gas has escaped, but proof of immediate action is obtained by other means.

The results obtained in experiments with malt wort can be used to explain the action of yeast in other cases.

In the use of yeast for bread-making large amounts are put into the dough, and the fermentative activity is of primary importance. Brewery yeast is unsatisfactory for bread-making, for it is rapidly inactivated at high temperatures (35° C.) by certain yeast poisons in the flour. Such yeast grown in distillers' wort is less sensitive, and can be used by bakers. According to J. L. Baker (1917) unboiled distillers' wort contains these toxins and the yeast crops from such media consist only of cells which are immune, and therefore of use to the baker. One suspects, however, that the hops in brewery wort play a part in making the yeast sensitive and useless for bread-making on a large scale. This case is of interest for rates of inactivation come into prominence.

Yeast activity takes place under many varied conditions. It is only by referring back to the simple constants of growth and fermentation, and to the factors which influence these constants, that the results can be interpreted and the process understood.

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NEWS FROM THE SECTIONS.

BRISTOL AND SOUTH WALES.

This Section is to be congratulated on its enterprise in arranging for two meetings to be held monthly instead of one as heretofore. On the first Friday of the month the Section will meet in the Chemical Department of the Bristol University, and on the second Thursday at University College, Cathay's Park, Cardiff. The first meeting of the new session was held in the latter locality on October 3, when Mr. W. R. Bird, vice-chairman of the Section, read a paper on "Fractional Distillation in the Laboratory and in Practice," and exhibited a number of still-heads.

A variety of types of still-heads was described and their advantages and defects pointed out. Special attention was drawn to the necessity of having the bottom of the column of the same diameter as the rest so as to obviate the flooding of the column, which usually happens when this point is neglected. The new form of still-head described by Dufton (see this J., 1919, 45 T) was particularly discussed, Mr. Bird's experience of it fully bearing out the efficiency claimed for it. Distillation with this apparatus yields practically pure products in one operation.

In describing types used in the factory, attention was drawn to the necessity of having large return-tubes to prevent flooding and to the devices for preventing contamination by mechanical spraying. It is generally necessary to use a long column—about 16ft.—with about 20 plates in it and then a dephlegmator. For soft waters, such as are common in South Wales, the dephlegmator tubes should be electro-coppered. The so-called "analysers" are worthless, but considerable success is obtainable with Raschig rings. A discussion followed.

At the meeting held at Bristol on October 9 it was announced that the membership of the Section had increased to nearly 200, and that nearly every local industry was represented in it.

In introducing the subject of "Works Control," Mr. C. J. Waterfall referred to the fact that at the annual meeting of the Society it was emphasised repeatedly that the recent efforts made in the chemical industries must not only be sustained but increased. In the dye industry we had to compete against the splendidly organised works of Central Europe, and with the accumulated technical knowledge of the past 53 years. The hitherto unutilised data in the chemist's notebook, although possibly not of immediate commercial value, might become at any moment of inestimable worth. A very imperfect system of education lay at the root of our troubles.

The position of the works' chemist was then compared with that of the engineer, and a plea entered for better representation of chemists on committees of management. Replying to a criticism that the chemist was not assisting the general manufacturer as much as he might do, the speaker pointed out certain broad directions in which the chemist is helping the manufacturing works in general, and could help more were he permitted. He instanced fuel, water supply, and lubrication, and urged a greater measure of scientific control of fuel consumption. It was suggested that a works should have a sort of balance-sheet constructed from the chemical point of view. The loss up the stack or in the liquid effluent would be taken into account, together with that mysterious waste that so often occurs in works management. The difference between the weight of goods in and the weight of goods out would be checked, discrepancies noted, and if possible accounted for. The comparison of costs between different works and the progress in economy of production brought about thereby was touched upon, also the value of manufacturers meeting together in their trade organisations.

Mr. E. Walls (chairman) pointed out that in the effort for increased output too much attention was directed to increasing the output of labour and not enough to scientific and mechanical means of increase. In many processes the increase of effort on the part of the individual labourer would have only a slight effect on the yield of the process, whereas the application of technical science might result in an improvement of method, followed by a great increase in yield. The standards and controls insisted upon by the Ministry of Munitions had in some works carried processes further forward in one year than in the previous fifty.

Dr. Butler pointed out that the Germans had absolute chemical control in their works, and did not seem to care how much they spent in obtaining it. No matter what the control costs, it was evidently a paying proposition in the end.

MANCHESTER.

On October 3, the new session was opened with an address entitled "Notes on the Rhineland Chemical Works," by the chairman, Mr. John Allan. This address will appear in our next issue.

MEETINGS OF OTHER SOCIETIES.

INSTITUTION OF PETROLEUM TECHNOLOGISTS.

The first meeting of the session was held on October 21. The president, Sir Frederick W. Black, was in the chair, and Mr. Arnold Philip read a paper on "Some Laboratory Tests on Mineral Oils." After an appeal for the adoption of standard methods of testing in the petroleum industry, the author dealt in detail with several methods which he had found to give concordant results not only with petroleum products, but also with products from coal-tar and low temperature carbonisation. Details were given of the preparation of representative testing samples from the bulk samples as received in the laboratory, particularly when such samples contained water in suspension, or as an emulsion, and this was followed by a description of a distillation method possessing several novel features for the valuation of crude oils. The distillation is carried out in two portions (1) a topping distillation in a glass flask, in which the products volatile below 260° C. are separated, and (2) distillation of the heavy residue in a metallic still of unique form, and fitted with internal baffle plates. In both distillations the stills are externally heated, a current of air of fixed volume per unit time being used in the first to carry off the vapours produced, and in the second either air or super-heated steam or both can be employed. In the first distillation a vacuum equivalent to about 8 in. of water is used, generated by a Lennox blower, but it was not stated if similar conditions obtained during distillation (2). A table was given showing results obtained by this method and those obtained by other workers on a particular crude oil, and also the results obtained by the author on a sample of petroleum from the Hardstoft well.

Dealing with the testing of motor spirit, a method of taking the temperature at which the vapour pressure is equal to atmospheric pressure was described, and suggested as an alternative to the recording of the temperature at which distillation commences.

In a section on the calorific value of fuels, the question of the water values and high and low

calorific values of fuels was exhaustively discussed, the author suggesting that the results should be reported as follows:—(1) The high calorific value determined by the bomb calorimeter. (2) The "water value" of the fuel, "that is, the total "number of units of weight of water obtained "from the combustion of unit weight of the fuel, "by which is meant the sum of the water derived "from the oxidation of the combined hydrogen in "unit weight of the fuel, together with the hygro-"scopic water contained in that weight. From "these two values any form of low or net calorific "value can be obtained by calculation." A method of estimating the "water value" was given. The determination of the amount of water in oils, tar, etc., was then discussed, and a vacuum distillation method used by the author described.

The final portion of the paper dealt with the effect of moisture in mineral oils upon their flash points. A long series of tests was described and tabulated, which brought out the abnormalities arising from this cause. In some oils the flash point is raised by the addition of moisture, while in others it is lowered; generally speaking, discrepancies in the observed flash points are greater in the case of moist oils than in the case of dry ones. In the author's opinion it is not necessary completely to dry oils having a flash point of less than 200° F. before making the tests.

In the discussion, the chairman, Sir Thomas Holland, Dr. Dunstan, Prof. Brame, and Dr. Ormandy all accentuated the need for the establishment of standard methods of testing in the petroleum industry. It was pointed out that the international nature of this question must not be lost sight of, especially with regard to the large amount of work that has been done in the United States. The formation of a preliminary committee for the consideration of this subject was urgently advocated. Dr. Dunstan and Messrs. Mitchell and Lomax criticised the methods of analysis employed by the author, particularly with regard to the method of distillation, suggesting that instead of preventing "cracking" it would tend to accentuate it, as many crude oils were very liable to decomposition when heated to 260° C. in the absence of steam, and also that the second heating of the residue would also have the same effect.

Dr. Dunstan gave an interesting comparison of the results of tests of Hardstoft crude oil, the analysis made by himself on 30 c.c.s. being compared with that given by the author and by Hackford.

	Dunstan.	Philip.	Hackford.
Benzine ...	... 5·0%	... 4·8%	... 4·5%
Kerosene	... 32·0%	... 37·5%	... 33·0
Lubricating Oil	30·0%	... 26·75%	... 29·0

Mr. Philip reserved his reply to these criticisms until the publication of the Society's Journal.

SOCIETY OF GLASS TECHNOLOGY.

The new session was opened at Leeds on October 15, under the presidency of Mr. S. N. Jenkinson.

The first paper read was "Some recent Improvements in the Designs of Glass Works Furnaces and Gas Producers," by Mr. J. A. Atkinson.

In small installations the use of coke gas has many advantages, for with a coke gas producer of good design the supply of gas is uniform in quality and quantity, and the use of skilled labour is unnecessary. A design of coke gas producer which was in successful use and in which the gas outlet is placed some distance down the side of the producer, instead of over the fuel bed, was described, and its very pronounced advantages detailed. In the absence of coke, a Siemens' Dry Bottom Producer with coal fuel can sometimes be employed with advantage, but it does not yield a regular supply of gas of uniform quality. Better types are the Dawson, Duff, and Wilson, all of which are provided with a water seal which permits of a constant gas supply during the clearing out of ash; on the other hand the quality and quantity of gass are liable to fluctuation.

Producers with revolving grates are very advantageous with certain grades of fuel, and these, in the author's opinion, should contain a very high percentage of ash; however, their prime cost is high and their upkeep expensive. The Talbot, Wood, Hughes, and Morgan producers to a certain extent satisfy the three essentials of a perfect producer, namely, constant feed of fuel, even distribution of fuel over the whole bed, and constant agitation of the upper portion of the fuel bed. The Chapman Agitator, with automatic feed, which can be fitted to most existing types of producers, is the most satisfactory.

Mr. Atkinson next described the recuperative pot furnace of the Stein type, in which the recuperative chambers are placed on either side of the furnace proper, and the air passages are vertical, so that by regulating the chamber chimney a flame pressure above the atmospheric pressure can be maintained around the pots in the furnace. The fuel consumption for a 12-pot furnace is 37-46 per cent. of the weight of glass produced. In conclusion, the author described a tank furnace with a novel arrangement of dampers which permits of control of the individual burners.

A paper on "The Manufacture of Table Ware in Tank Furnaces" was then read by Mr. R. L. Frink, in which he described how high-class crystal glasses, both flint and crown, can be produced in tank furnaces. In his opinion it was possible, with a well-designed furnace, properly operated, to produce a lead glass far superior in quality and homogeneity to any which could be made in pots.

OIL AND COLOUR CHEMISTS' ASSOCIATION.

At a meeting held on October 9, Mr. H. H. Morgan in the chair, Mr. A. de Waele presented two contributions. In the first, "Permeability of Paint and Varnish Films," he described a method of determining permeability to moisture by cementing the film to be tested on to the mouth of a flat-lipped CO_2-flask containing strong sulphuric acid. The flask is kept in an incubator in a saturated atmosphere and weighings made every three hours. The films are prepared by coating tinned iron plates with the varnish or paint, allowing several days for drying, and then amalgamating one edge of the plate with mercury and dilute sulphuric acid; after a few hours the film can be pulled away quite readily. The results showed that for any given pigment, the proportion of medium (spirit-free) to 100 parts of pigment was inversely proportional to the porosity of the film. When comparing different pigments, the impermeability, for a given proportion of pigment to medium, was influenced inversely as the specific oil absorption of the pigment, the specific oil absorption being the minimum proportion of oil necessary to convert the dry pigment into an unmistakeable paste.

The permeability of a varnish film to moisture, as determined by this test, affords no indication as to whether it will protect an iron plate from rusting. Accordingly experiments were made, by using a form of Donnan Osmometer, to test the permeability of these films to ions. It was found that sodium chloride passed freely through the film.

Experiments were also described on the determination of the cause of the "chalking" or "blooming" which takes place when clear oil-varnish films are immersed in water. No very definite conclusions, however, were arrived at.

Although many varnishes made from tung oil do not show this "chalking" effect, such varnishes are not necessarily less permeable to moisture than a linseed-oil varnish which "chalks" on immersion.

The second paper was on "A Suggested Method for Calculating Costs of Ready-mixed Paints." The principle stumbling block in the calculation of ready-mixed paint formulæ is to predict the amount of medium required to thin down the oil paste containing the pigments to the desired fluidity. If, however, instead of thinking of the paste in terms of lb. or cwts., its volume be calculated, from a knowledge both of its composition and of the specific gravities of its constituents, then the following simple rule will be found to hold good over a very wide range of colours:—The ratio of volume of paste to volume of thinners is constant, no matter what the pigment or mixture of pigments contained in the paste may be. This formula will yield ready-mixed paints of uniform fluidity and ease of working. It is, of course, assumed that the composition of the thinners used remains the same throughout and that the paste contains that minimum amount of oil necessary to convert the dry pigment into an unmistakeable paste.

PERSONALIA.

Mr. E. de Barry Barnett has been appointed lecturer in organic chemistry at the Sir John Cass Technical Institute, Aldgate.

Dr. Theodore W. Richards, professor of chemistry at Harvard University, has been elected president of the American Academy of Arts and Sciences.

Dr. F. J. Charteris, lecturer in pharmacy at Glasgow University, has been appointed to the chair of materia medica at the University College of Dundee.

Capt. J. W. McBain, lecturer in physical chemistry in the University of Bristol, has been appointed to the new chair of physical chemistry in that university endowed by Lord Leverhulme.

Sir H. A. Meyers, vice-chancellor of the University of Manchester, has been appointed by an Order of Council dated October 16, 1919, to be a member of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research.

In consequence of Lord Wilton having decided to discontinue the Wilton Research Laboratories, Mr. F. W. Atack has been appointed director of the research department of the British Alizarine Co., with headquarters at 57, Dale Street, Manchester.

Mr. B. Mouat Jones has been appointed professor of chemistry at the University College of Wales, Aberystwyth, in succession to Prof. J. J. Findlay. Mr. F. W. Fagan, of the East of Scotland Agricultural College, Edinburgh, has been appointed adviser in agricultural chemistry at the same college.

Salters' Institute of Industrial Chemistry.—In furtherance of its policy of promoting the study of chemistry among industrial workers, the Committee of the Institute has recently awarded grants-in-aid to thirty young persons occupied in chemical factories in or near London to assist them in improving their knowledge of the subject.

NEWS AND NOTES.

UNITED STATES.

Reported Discovery of a New Alkaloid.—It is stated that a new alkaloid has been extracted from *Covillea tridentata*, a shrub which is very common in the semi-arid districts of Mexico. The discovery is claimed by chemists of the U.S. Department of Agriculture and of the Bureau of Plant Industry.

Autumn Meeting of the American Chemical Society.—The meeting held in Philadelphia from September 2—6 was the largest on record, over 1700 members being present. The membership of the Society is now approaching 14,000. Several important resolutions were passed. An emphatic protest was made against the Bill before Congress providing for the reorganisation of the Army, mainly because it does not extend to technical men the same recognition and opportunity throughout every grade and department as are accorded to those trained solely for a military career. The proposed abolition of the Chemical Warfare Service was also disapproved, and a motion was passed urging the vital necessity of adequately remunerating chemists in the national service. It was also resolved to invite the councils of the Chemical Society (London) and the Society of Chemical Industry to appoint a committee or committees on nomenclature, spelling and pronunciation, to co-operate with the corresponding committee of the American Chemical Society in order to secure as large a measure of agreement in these fields as is practicable.

The newly-formed Section of Dye Chemistry held its first meeting with an attendance of over 300, and a Section of Sugar Chemistry was initiated. The Division of Rubber Chemistry held an unusually successful meeting, twenty-two papers being presented and discussed. In the Division of Industrial and Engineering Chemistry a symposium was held on refractories and another on patents, at which much attention was given to the question of annual patent fees for the United States. The Society has been studying patent reforms as affecting the chemical industry for some time past, and legislation is now pending which, if enacted, should do much to improve present conditions.

The programme included nineteen excursions to various industrial plants. In 1920 the Society will meet at St. Louis in the spring and at Chicago in the autumn.

Magnesium in 1918.—The United States produced, in 1918, 284,188 lb. of magnesium metal valued at $615,217, representing an increase of 145 per cent. in quantity, and 163 per cent. in value, over the output of 1917. About three-fifths of the total was sold as sticks and two-fifths as powder. The price was approximately equal to the pre-war price of imported magnesium, *viz.*, from $1·6—2 per lb. Its purity varies from 99 to 99·9 per cent.; the most common impurities being iron, calcium, sodium, potassium, chlorine and oxygen. Of these sodium is the most objectionable, especially where the metal is used for alloys. Some work recently done by the Bureau of Standards in the Washington laboratories gave the following values of physical properties on a casting of 99·9 per cent. purity. Density 1·737 at 20° C., average co-efficient of expansion between 0° and 100° C., 0·0000259 per degree C. It is stated that the metal is barely attacked by a mixture of equal parts of strong sulphuric and fuming nitric acids. Magnesium is extremely useful as a deoxidiser in foundry work. One pound of magnesium will deoxidise from 1200 to 3000 lb. of copper, and is being preferably used in the form of a 10—20 per cent. magnesium alloy with copper. The properties of

the various magnesium alloys are now well known, but a new suggested use is in bearing metal, the wear of the alloy being about half that of best cast iron.—(*U.S. Geol. Survey, July*, 1919.)

SOUTH AFRICA.

Industrial Notes.—*Sugar.*—The present season's sugar crop is expected to be between 150,000 and 160,000 tons, which is fully up to the milling capacity.

Chloroform.—The manufacture of this anæsthetic is about to be undertaken by the Natal Cane By-products, Co., Ltd., and will be run in connection with its ether plant.

Wattle.—A wattle extract factory is to be erected at Paddock, near Port Shepstone, Natal. The plant will be capable of treating 5000 tons of green bark per month.

Bat Guano.—It is reported that a supply of bat guano, calculated to be sufficient to supply all Rhodesia for the next ten years, has been discovered in a series of caves on the north bank of the Umniati river, some forty-five miles from Gatooma. In some places the guano deposits are 20 feet deep. It is expected that the material will be placed on the market forthwith.

Fibres.—In the opinion of a firm of fibre importers in Scotland, the fibre from the South African baobab tree is probably the finest papermaking material that can be found.

A report received from the Imperial Institute on some samples of wild South African kapok (Asclepias floss), states that the material is inferior to other commercial flosses such as Java kapok, Indian kapok, and Akund floss, but that it could be used as a stuffing material in upholstery.

The Institute has also reported on a sample of fibre of *Sida rhombifolia* which is found widely spread and in fair abundance throughout the Union. The sample contained:—Cellulose 76·5 per cent., ash 1·1 per cent., and moisture 10·7 per cent. It behaved normally towards chemical reagents and was not silky. It was, however, of short staple, but this could probably be remedied by cultivation. The product would doubtless find a market in the United Kingdom.—(*S. Afr. J. Ind., July, Aug.*, 1919.)

AUSTRALIA.

Mineral Production of Western Australia in 1917.—According to a recently issued report of the Department of Mines the following quantities of the more important minerals were produced and exported during 1917:—

	Produced. Quantity. Tons.	Produced. Value. £	Exported. Quantity. Tons.	Exported. Value. £
Coal	326,550	191,822	—	—
Copper ore ..	6,488	93,711	960	20,878
" matte, etc.			535	64,800
Lead-silver, ore and concentrates	46,864	144,684	22	593
Lead (pig) ..			4,601	139,940
Tin ore	307	39,192	383	45,288
Pyritic ore	3,575	1,752	—	—
Molybdenite	—	—	14	158
Magnesite	20.5	21	42	50
Antimony	—	—	12	258
*Gold (fine oz.) ..	—	—	970,317	4,121,645
Silver " ..	—	—	222,075	38,339
Tantalite	12.5	1,782	17	2,513

* Exported and minted.

In addition, about half a ton each of bismuth ore and scheelite was exported. No asbestos, mica or wolfram was exported or reported as having been produced during 1917. Coal shows an increase of 25,024 tons over the production in 1916, the whole output coming from the Collie coalfield. Copper was obtained chiefly from the Phillips River, West Pilbarra and Peak Hill Goldfields. The exports of ore and matte show an increase over 1916 amounting in value to £20,905. The lead ore exported shows a decrease of £11,440, but this is compensated by an increase of £65,010 in the value of pig lead exported. Practically the whole of the lead ore was raised in the Northampton Mineral Field. About three-quarters of the production of tin was obtained from Greenbushes Mineral Field, the remainder coming from the Marble Bar district of the Pilbara Goldfield. The exports show a decrease of 80 tons compared with those reported for 1916. The production of gold has been falling since 1904, and shows a further decrease of 386,887 oz., although the recovery per ton of ore increased from 40·34s. to 41·49s. Over 50 per cent. of the output was obtained from the East Coolgardie goldfield. Silver, which is recovered as a by-product in lead smelting, shows an increase of 49,063 oz. Magnesite was obtained from the deposits at Bulong, where the mineral occurs in a fairly pure form in short irregular veins, but these rarely attain a diameter of more than one foot. A small amount of work was done on the graphite deposits at Donnelly river, but none of the mineral was exported.

The Pottery Clays of Western Australia.—Recent investigations into the quality of the pottery clays of Western Australia have been attended with satisfactory results. A very large number of samples obtained from various localities has been tested by the special committee of the Institute of Science and Industry, and considerable public interest has been aroused in the initial experiments. A syndicate which has erected a trial plant for the manufacture of domestic white ware has been in constant touch with the laboratory, and has received advice as to materials and the manipulation of the clays. Endeavours are now being made to convince local potters and brickmakers of the advisability of using some form of temperature indicator in their kilns.—(*Science and Industry, July*, 1919.)

FRANCE.

General Industrial Outlook.—The industrial outlook in France is at present conditioned mainly by two factors: the unfavourable rate of exchange and the transport difficulty. The former is driving home the urgent need for greater production in order to increase exports, and this depends on the second factor, which is of an entirely local order, being handled in the proper way. Unfortunately the strike fever prevails here, too, and the effects of the recent railway strikes in Lorraine and the dockers' strike at Marseilles are still being felt. In Lorraine especially the potash industry has been paralysed and production is still at a low level. At Marseilles goods have been accumulating, and during the strike the city has been lifeless. The market for potash and sodium salts fluctuates continually. Sodium bisulphites are less rare, but sodium thiosulphate for photographic purposes, although derived from the former, shows an increase of 10 francs per 100 kilo.

Labour difficulties are being experienced in Algeria and Tunis. The latter colony is trying to extend the mechanical exploitation of its phosphate ores. The "Compagnie des Phosphates de Constantine" is taking the lead in this direction and claims that, with restricted hand-labour, it can treat 100 tons per hour. In the soap industry the "Consortium de la Savonnerie Française" has been dissolved. It seems that *consortia* are not popular in France and that firms prefer to lead an individual existence. The need of printed tissues is enormous in spite of the prohibitive prices for dyes, and is responsible for the formation of "La Société Anonyme de Teinture et d'Apprêts de la Loire," with head offices at St. Etienne, 17, rue des Teinturiers. Antwerp has definitely been chosen by France to be the clearing port for her commerce with the Rhineland provinces. The com-

mercial base that had been temporarily established at Rotterdam has in consequence been abandoned.

In the metallurgical world an event of importance is the result of the referendum lately taken in Luxembourg, which by a large majority decided in favour of a Customs union with France. Before the war this country produced 2,550,000 tons of pig iron and 1,335,000 tons of steel. This production, added to the French production, makes France the first metallurgical country in Europe and the second in the world.

Present Position of the Alsatian Potash Industry.—In the September issue of *The Chemical Engineer*, Dr. F. K. Cameron, of the United States Bureau of Mines, states that in April last the work of putting the Alsatian potash mines in order was progressing satisfactorily. There were then on hand some 150,000 tons of kainite and 400—500 tons of concentrated salts, containing, respectively, about 18 and 50% of K_2O. The daily output was about 2500 tons of crude salts. It is impossible to arrive at any accurate figures as to costs of production, particularly in view of the fact that the Germans carried off or destroyed all records, and the following estimates must be regarded as "intelligent guesses":—

Cost of Production of Sylvenite (dollars).

	Average of 18% K_2O or more.	Average of 45% K_2O or more.
Mining	4·00	10·00
Milling	0·85	4·12
Bagging	1·50	1·50
Renewals and repairs ...	1·00	4·50
Office charges	0·75	1·88
Interest, etc.	1·00	3·75
Freight	2·00	3·00(?)
Total	11·10	28·75
Cost per unit K_2O ...	0·617	0·639

Charges for amortisation and taxes are not included.

As regards transport, all the plants are connected with the main line between Basle and Strasbourg. Canal transport is available to Marseilles by the Rhine—Rhone Canal, and before long Mulhouse or Strasbourg will be connected by waterway with Havre.

There are at present nine mines (two French and seven German), each of which is provided with two shafts (500—1000 ft. apart, connected below ground and used for ventilation). One thoroughly equipped shaft is capable of bringing up 800 tons of ore daily, and if both were used for hauling the daily output could be increased to 15,000 tons, equivalent to a million tons of K_2O yearly. Unfortunately the labour supply is very poor, few of the employees have had any previous experience of mining, and there is a great scarcity of men competent to act as mine bosses, coal miners from Lens filling these positions at present. It is improbable that any new shafts will be sunk for some time, as existing mines are not equipped up to full capacity. The estimated pre-war cost of establishing a mine is about £600,000.

Growth of the French Chemical Industry.—According to the president of the "Groupement des industries chimiques," French chemical industry developed tremendously during the war. The annual output of sulphuric acid was increased from the pre-war figure of one million tons to two million tons. The monthly output of nitric acid during 1918 amounted to 50,000 tons compared with an annual output of 15,000 tons in pre-war days. The yearly output of cyanamide has increased from 8000 tons in 1913 to 100,000 tons at the present time. Owing to the sudden cessation of hostilities, there is now an over-production of these products to be contended with, a feature not confined to France but affecting all countries. Prospects are favourable for the absorption of part of the output in agriculture. In particular, viniculture should benefit. Copper sulphate is indispensable in the vine industry, and of the annual import of this chemical, amounting to 50,000 tons, viniculture absorbed 40,000 tons. It is unfortunate that the necessary copper, mined in Spain, is controlled by English interests, which also manufacture copper sulphate. (*Schweiz. Chem.-Zeit., Sept.* 10, 1919.)

GENERAL.

The British Association and Post-War Scientific Research.—The following resolution, adopted by the British Association at Bournemouth, has been addressed to the Prime Minister and the Chancellor of the Exchequer:—

"The British Association for the Advancement of Science, in reviewing the results of scientific methods applied to military and other practical arts, recognises that the successful issue of the war has sprung from the efforts of scientific men concentrated on those problems, and with the conviction that the well-being and security of the nation is dependent on the continuous study of such matters, would urge on H.M. Government the necessity for apportioning an adequate sum from that allocated to home administration and the up-keep of the fighting forces for the purpose of a definitely organised scheme of research, as for example on problems connected with health, food, and commerce, on explosives, on chemical warfare, and on physical and engineering problems bearing on military work."

Similar resolutions have been sent to other Ministers.

Driving off Poisonous Gases.—The current issue of the *Proceedings of the Royal Society* (Series A. **96**, No. A. 676) contains a paper on this subject by Mrs. H. Ayrton which was received in August, 1917, but was held over for publication after the war. Laboratory experiments are described in which cooled smoke from smouldering brown paper was driven back along a large table by tapping with a small fan upon a miniature parapet erected at the further end of it. The best result was obtained with a wooden fan of 1½ sq. in. area (including the back); by tapping with this for 6 seconds at the rate of 4 taps a second, an advancing smoke cloud about 6 ft. wide and about 3 in. high was very effectively rolled backwards. The method here indicated was in daily use at the Front since May, 1916, chiefly for clearing trenches, shell holes, mine craters, etc., of foul gases. The Army fan is made of waterproof canvas stiffened with cane with a wooden handle. It is 3 ft. 6 in. long, has a blade 15 in. square with a loose end and side flaps, and weighs less than 1 lb. These hand-driven fans are not sufficiently powerful to repel gas-wave attacks in comparatively high winds. Further experiments showed that such a fan in action divides the surrounding space into two areas, separated by a vertical plane parallel to the tip of the blade. Air, in irrotational motion, is sucked from behind the fan in all directions towards it, and is driven forward away from it in rotational (vortex) motion. Each successive stroke produces a vortex, the vortices combine, pool their energy, and attain a far greater distance than any single one. The limiting distance with a 1½ in. model fan was about 10 ft., *i.e.*, 80 times its length. The author intends to study further the problem of expelling undesirable gases by hurling vortices into them. The bearing of these experiments on ventilation in chemical works will be obvious.

War-Time Activities of Dye Plants in Germany.—The following data are taken from the report of the British mission appointed to visit enemy chemical factories in the occupied zone.

By the amalgamation during the war of previously-formed combinations of chemical companies an association was formed known as the Interessen-Gemeinschaft (I.G.), which includes the large companies like Fr. Bayer and the Badische company and some smaller firms. The I.G. works, some of which are outside the occupied area, and were therefore not visited, produced the bulk of the synthetic ammonia and nitric acid needed for the production of fertilisers and explosives, all the poison gas (with the exception of some chlorine and phosgene), and a large proportion of the high explosives. The information as to the war production of the factories visited must be accepted with some reserve.

Explosives.—No arrangements appear to have been made before the war to utilise any of the dye factories for war purposes, and on mobilisation their chemists were called up for military service. Most of the chemical works, however, were producing small quantities of explosives by the end of 1914, but it was not until 1916 that plant was laid down to assist in the enormous production required by the Hindenburg programme. Many chemists were then released from the army, and most of the big extensions of the synthetic ammonia and of the nitric and sulphuric acid plants date from that time. The expansion of output by the factories of the I.G. combination during the war is shown in Table I.:—

I.—OUTPUT IN METRIC TONS PER DAY.

	Nitric acid.		Sulphuric acid.		Chlorine.	
	1914.	1918.	1914.	1918.	1914.	1918.
Leverkusen ..	56	180	340	470	7	20
Höchst ..	150	375	224	280	1	8
Oppau ..	?	100	—	—	—	—
Ludwigshafen..	40 (?)	40	275	410	13	35
Weiler-ter-Meer	12	24	48	60	—	—

Of the above works, Oppau and Merseburg produced 250 and 400 tons, respectively, of ammonia in 1918, compared with 25 and nil in 1914.

Oppau can now produce 500 tons of nitric acid daily while still retaining sufficient ammonia for the output of nitric acid at Höchst.

Large new vitriol plants have been erected at Höchst and at Domagen.

Standardised plant for the manufacture of dyes was converted with remarkable speed; for instance, at Leverkusen a TNT plant producing 250 tons a week was put into operation in six weeks. Table II. shows the production of the principal high explosives in the factories visited and of intermediates where these were not converted to finished explosives in the producing works:—

II.—OUTPUT IN METRIC TONS PER WEEK.

	Ammonium nitrate.	Dinitrobenzene.	Dinitrotoluene.	Trinitrotoluene.	Dinitronaphthalene.	Dinitrochlorobenzene.	Picric acid.
Leverkusen ..	—	250	—	250	150	40	—
Domagen ..	—	—	—	—	—	—	600
Urdingen ..	—	60	—	75	—	—	—
Höchst ..	500	140	—	200	—	—	—
Ludwigshafen..	—	25	50	—	15	300	—
Oppau ..	200	—	—	—	—	—	—
Wiesdorf ..	—	—	120	—	—	—	—
Schlebusch ..	100	—	—	150	—	—	—

Ludwigshafen also produced 100 tons of sodium benzene sulphonate, 35 tons of dinitrophenol and 25 tons of dinitrodiphenylamine per week; Schlebusch 15 tons of hexanitro-diphenylsulphide, and Höchst 30 tons of trinitroanisol per week.

Poison gases.—At first chlorine and phosgene were the main requirements, but afterwards a variety of organic substances was employed. When the Government wished to introduce a new gas a conference of the various firms was held at Berlin to determine how the manufacture should be subdivided in order to use existing plant to the best advantage for the new and sometimes difficult preparations. For example, the initial stages of the manufacture of mustard gas were carried out at Ludwigshafen, and the final stage at Leverkusen. The output of finished poison gases from the works visited is shown in Table III.; large quantities of intermediate products were also sent to other factories:—

III.—OUTPUT IN METRIC TONS.

Poison.	Factory.	Average monthly output.	Total Production if known.	Date of commencement.
1. Chlorine ..	Leverkusen..	600	—	Prior to war.
	Höchst ..	240	—	,,
	Ludwigshafen	860	38,600	,,
2. Phosgene ..	Leverkusen..	30[1]	—	,,
	Ludwigshafen	288	10,682	,,
3. Diphosgene	Leverkusen..	300[1]	—	June, 1915.
	Höchst ..	139	3,616	Sept., 1916.
4. Chlorpicrin..	Leverkusen..	200[1]	—	July, 1916.
	Höchst ..	45	1,127	Aug., 1916.
5. Xylylbromide	Leverkusen..	60[1]	—	March, 1916.
6. Bromoacetone and	Leverkusen..	20[1]	—	July, 1916.
bromoethylmethylketone	Höchst ..	19	685	April, 1915.
7. Phenylcarbylamine chloride ..	Höchst ..	65	721	March, 1917.
8. Mustard gas	Leverkusen..	300[2]	4,500	Before July, 1917.
9. Diphenylchloroarsine ..	Höchst ..	150	3,000	May, 1917.
10. Ethyldichloroarsine ..	Höchst ..	78	1,092	Aug., 1917.
11. Dichloromethyl ether	Höchst ..	26	239	Sept., 1917.
12. Dibromomethyl ether	Höchst ..	7	69	Aug., 1917.

(1) Maximum monthly output.
(2) Estimated.

The manufacture of diphenylcyanoarsine was begun at Höchst in February, 1918. (*Chem. and Met. Eng., Sept.* 1, 1919.)

Irish Industries during the War.—A report by the American Vice-Consul at Dublin gives a number of interesting facts concerning the effect of the war on Irish industries. In agriculture, the largest industry, there was an increase in the cultivated area of nearly a million acres between 1916 and 1918. The cereal production was 1,786,166 tons in 1918 against 1,111,378 tons in 1916; root crops during the same period increased from 9,604,613 to 11,546,755 tons. Owing to the large demands for military and aeronautical purposes, the flax and linen industry has made great progress. In 1918 there were 140,000 acres under flax, while in Belfast 70,000 people (nearly one-fifth of the population) were engaged in the linen industry. The returns of the stock-raising industry show considerable decreases in the number of horses, cattle, sheep and pigs as compared with pre-war times.

Much prospecting has been done in regard to minerals, but during the war there has been an all-round falling off in production. A large amount of low-grade copper ore has been proved in County Wicklow, and it is hoped that antimony will be worked shortly in County Monaghan. Borings are being made to determine the deposits of cannel coal, but no results are yet available. The total reserves of good quality coal remaining in Irish coalfields is estimated conservatively at 300 million tons. It is interesting to note that there are extensive deposits of barytes at present undeveloped, and that the soapstone quarries of the North of Ireland produce the bulk of the output of the United Kingdom.—(*U.S. Com. Rep. Suppl., June* 16, 1919.)

LEGAL INTELLIGENCE.

Customs Seizure of Pyrogallic Acid. *Brown and Forth v. Buckley* (see this J., 1919, 379 R.)

An application was made on behalf of the plaintiffs to Mr. Justice Younger in the Chancery Division on October 14 that a day should be fixed for the speedy trial of this action, without pleadings.

Mr. R. H. Wright, for the plaintiffs, said that this was a case of the utmost importance not only to his clients but to the public generally, in fact it raised the question whether it was possible to practise tariff reform by executive act without the express sanction of Parliament.

Mr. Justice Younger said counsel would have to agree as to whether they were to bring on the motion started before the Vacation Judge, or whether the action was to be tried without pleadings before him (Mr. Justice Younger), in which case the Crown must assent.

The Attorney General said that he could not give his assent. The whole action was misconceived. A question was raised—he admitted a very serious question—as to whether the Proclamation in question was *ultra vires*, but every argument that the plaintiffs could adduce in this action could be equally well presented in the proceedings under section 207 of the Act which the Crown had instituted for condemnation of the goods. Furthermore, the proceedings were directed against the wrong defendant. The Collector of Customs was only a subordinate officer, who could not return the goods even if the order were made upon him to do so. He could not give his assent to this application, but he would do all in his power to expedite the proper proceedings.

His Lordship remarked that he thought it possible that if the plaintiffs got their order in this action they might not obtain recovery of their goods, and ordered that the case should be tried with pleadings.

Fire and Explosion at a TNT Factory. Claim against Insurance Companies. *Hooley Hill Rubber and Chemical Co., Ltd.* v. *Royal Insurance Co., Ltd. and Others.* (See this J., 1919, 193 R.)

In the Court of Appeal on October 17 and 20, Lords Justices Bankes, Scrutton, and Duke had before them an appeal by the Hooley Hill Rubber and Chemical Co., Ltd. from a decision of Mr. Justice Bailhache upon a special case stated by Mr. A. M. Langdon as sole arbitrator in a dispute which had arisen between the appellants and the Royal Insurance Co., Ltd., the Atlas Assurance Co., Ltd., the London and Lancashire Fire Insurance Co., Ltd., and the Motor Union Insurance Co., Ltd. The question was as to the liability of the insurance companies under policies of fire insurance upon premises belonging to the appellants.

The premises in question consisted of a TNT factory at Ashton-under-Lyne. A fire broke out in the factory, and after it had been burning for about 20 minutes the heat exploded a quantity of TNT which was in a closed receptacle. There was a clause in the insurance policies which excepted damage caused by explosion, but the assured contended that the clause did not exempt the insurance companies from liability for damage by explosion where the explosion was "only incidental to and in the course of the fire."

The arbitrator decided that under the terms of the policies the insurance companies were not liable for damage arising from the explosion, and that view was affirmed by Mr. Justice Bailhache. Hence the present appeal of the assured.

Mr. Justice Bankes, in giving judgment, said that the point for decision was undoubtedly an important one in fire insurance law. The contention for the assured was, broadly stated, this: That the contract between the parties was a contract of indemnity, and that the general rule in reference to such a contract ought to be applied in this case, namely, that in considering what the cause of the particular damage was, the proximate cause, or what had been referred to in the recent case of Leyland v. the Norwich Union Society in the House of Lords, as the efficient or the effective or the dominant cause, must be looked at, and that if that were done in the present case it was plain that the fire which brought about the explosion which caused the damage was the proximate and effective cause of the loss. On the other hand the general principle applicable to policies of insurance was not disputed; but it was said that there was another general principle, namely, that parties might by express language exclude the operation of that rule in any particular case; and it was said that the rule had, in the particular contracts between these parties, been excluded in express and unambiguous language. It appeared to his Lordship that the important point which had to be decided was whether the contention of the insurance companies with reference to the construction to be placed upon the exceptions in these policies was or was not correct. In his opinion upon the true construction of the exemptions in the policies, any loss due to the explosion was not covered by the policies. But the matter was covered by the case of Stanley v. The Western Assurance Co. (Law Reports, 3 Exchequer, page 71), in which it was laid down that if there were a fire, in the course of which an explosion occurred, for the result of the fire, unconnected with the explosion, the defendants made themselves liable, but not for any consequences of the explosion. For these reasons he thought the arbitrator and Mr. Justice Bailhache were right. Lord Justices Scrutton and Duke concurred.

There was a second question concerning the Royal Insurance Company only, namely, whether that company was estopped from relying on the exception, and as to which the arbitrator and Mr. Justice Bailhache decided that there was no estoppel.

It was agreed that this question should stand over for a week, with a view to the parties coming to an agreement upon it. On this understanding the appeal as regards the insurance companies, other than the Royal Insurance Co., was dismissed with costs.

PARLIAMENTARY NEWS.

HOUSE OF COMMONS.

Oil in Derbyshire.

Mr. Bonar Law, in reply to Mr. Holmes, stated that the Government has come to the decision that no royalty should be payable in the case of oil.—(Oct. 22.)

Importation of German Potash.

In answer to Mr. Chadwick, Sir A. Geddes said that the Board of Trade, since the armistice to date, had placed contracts abroad only in respect of timber and potash. In regard to the latter, the one contract entered into with the German Government represented an amount of £750,000.—(Oct. 22.)

REPORTS.

Annual Report of the Chief Inspector of Factories and Workshops for the year 1918. Pp. 83. [Cmd. 340, 9d.] (*London: H.M. Stationery Office.*)

The present report reviews in considerable detail the abnormal conditions introduced into factory and workshop administration during the period of the war. Of the ten sections the most important to the Chemical Industry is that devoted to industrial poisoning, contributed by Dr. T. M. Legge, H.M. Medical Inspector of Factories.

The incidence of lead poisoning is determined principally by the practicability or otherwise of the efficient removal of dust and fumes by locally applied exhaust ventilation. Where this is practicable great improvement is possible; where it is not the number of cases of poisoning will either increase or remain stationary. It is regarded as axiomatic that all risk lies in the inhalation of dust and fumes. The actual handling of lead is rarely shown to be a cause of poisoning. Subsidiary means for minimising the effects of lead, such as are afforded by cleanliness, periodic medical examination, labour saving devices, movement study, and research on efficient substitutes for lead, must not be neglected.

A recrudescence of "phossy jaw" occurred during 1915-1918, after an immunity extending over many years. Eleven cases were reported from the factory where phosphorus was manufactured, while only one case occurred elsewhere. Careful attention to the teeth of the workers, in the first place by a dentist, supplemented where necessary by the services of a surgeon of the highest standing, is now provided in the factory, and no cases of poisoning have been recently reported. It is interesting to note that the greater proportion of the cases of poisoning occurred with men engaged on the condenser side of the factory. An efficient system of exhaust ventilation is essential, and, further, phosphorus and phosphorus muds must be quickly removed from the condensers.

The increase in the number of cases of arsenic poisoning is attributable mainly to the manufacture of arsenic trichloride. There is danger even when the process is carried out in the open air, or when an exhaust draught is provided for the vessel in which the reaction between sulphuric acid, common salt, and arsenic takes place. Cases of poisoning by arseniuretted hydrogen occur principally in processes connected with the manufacture of zinc and zinc salts. Cases also occurred in the manufacture of intermediate dyestuffs wherein zinc and hydrochloric acid are employed either together, or when the acid is added at a stage subsequent to the reduction. The use of de-arsenicated acid and metal requires attention. At present safety from poisoning by arseniuretted hydrogen depends entirely on the efficiency of the measures taken to prevent escape of the poisonous gases.

The figures for mercurial poisoning show an increase during 1916 and 1917, mainly due to the greatly increased use of fulminate of mercury. The recognised symptoms of mercurial poisoning were present in only a few cases; in the majority the symptoms exhibited were dermatitis of the face, neck, hands, and forearms, associated with conjunctivitis and inflammation of the mucous membrane of the nose and larynx. As a preventive measure the workmen were instructed to dip their hands in a 10 per cent. solution of sodium hyposulphite. The conjunctivitis is beneficially treated by means of a similar 2 per cent. solution.

Anthrax cases increased noticeably during the period under review. It appears that liming, with a view to the destruction of anthrax spores in hides and skins, does not make the handling of these materials in later stages very much safer.

In November, 1915, toxic jaundice due to tetrachlorethane or nitro—or amido—derivatives of benzene or other poisonous substance was added to the list of diseases in Section 73 of the Factory and Workshop Act, 1901. A highly efficient system of ventilation is essential in factories where such products are manufactured or employed. Precautionary measures, embracing a complete change of underclothing and overalls, locally applied exhaust, daily examination of urine, have furnished a complete safeguard against poisoning by dinitrophenol.

In the category of poisoning by fumes and gases are included casualties due to blast-furnace gas, power gas, coal gas, gas from coke fires and lime-kilns, carbon dioxide, nitrous fumes, petrol and benzol vapours. Cases of poisoning due to carbon dioxide are nearly always fatal. Exposure to nitrous fumes for more than two minutes causes asphyxiation and death while after exposure for something less than two minutes the men rapidly recover on returning to the open air. Efficient ventilation is a prime necessity in all processes employing benzol. Hæmorrhages from the mucous membranes of the gums and nose afford an early indication of the desirability of the exclusion of the affected workmen from duty, with a view to the prevention of chronic benzol poisoning. As an alternative to benzol as a rubber solvent "Xylol compound" can be employed, with very much less danger of causing aplastic anæmia and purpura than benzene.

Protective measures against pitch ulceration include the wearing of protective clothing above the ordinary clothes, spray baths, and the necessary first-aid equipment. Outbreaks of eczema were attributable to (1) chemical irritants such as bichromate of potash, arsenious acid, and certain finished dyes; (2) solvents of the natural grease of the skin, *e.g.*, turpentine, benzene, and its homologues and their derivatives; (3) alkalis, etc., which soften and macerate the skin; and (4) processes such as brushing, etc., which mechanically break the skin.

The past year has witnessed a great advance in the voluntary movement on the part of employers and workmen to reduce hours of labour. An interesting feature of the movement is the increasing number of cases in which work before breakfast is being abandoned. In Chapter I. the effects due to these innovations are instanced by reference to various industries. Generally it may be stated that, almost without exception, reports from employers are entirely favourable to the new system, while the workmen express general approval. The efficiency of the workers has been increased and timekeeping improved. The new system affords a means of increasing the total national production, while costs of production are diminished. The necessity for overtime is obviated.

In regard to the prevention of works accidents, it is remarked that accidents preventable by the institution of safeguards represent only a very small proportion of the whole. A leaflet dealing with Safety Committees is issued by the Home Office (price 1d.) and the Report discusses in detail the constitution and functions of such committees, and the importance of furthering their more general establishment is strongly urged. More particularly in large works, safety inspectors should be appointed to act either in conjunction with or independently of such committees.

The period since 1914 has witnessed a great increase in the use of various labour and fatigue saving appliances, in the textile trades more particularly. Considerable developments in plant for handling material are anticipated in the near future. The subject of "movement study" is receiving increased attention. Efficiency is inti-

mately related to the satisfactory planning and arrangement of the factory. Apparently trivial matters such as the shape and size of tool handles, the provision of lighter barrows and spades have an important bearing upon the fatigue of the workmen and their efficiency. These and kindred matters are discussed in the chapter devoted to labour-saving appliances, illustrations being drawn from a diversity of trades.

The Report also deals at length with the recent growth of welfare work in factories. Such subjects as drinking water, canteens and messrooms, protective clothing and cloak-rooms, facilities for washing, ambulance and first aid, rest-rooms, supply and use of seats receiving attention. It is anticipated that the effect of Home Office welfare orders, combined with the growth in strength and influence of the Welfare Workers' Associations and the Workers' Educational Association, will in time become very great.

In the chapter dealing with the use of electricity in factories emphasis is laid upon the inadequate realisation, both by employers and medical men, of the possibilities of artificial respiration in cases of apparent death from electric shock. Artificial respiration should be persevered with for at least two hours, or until the patient revives.

The subjects of Ambulance and First Aid and Continuation Classes are dealt with in separate chapters.

Report of the Proceedings of the Industries Advisory Board and of the Scientific and Technical Committee. *Jan.-Sept.* 1918. *and* of the Advisory Board of Industry and Science. *Union of South Africa.* (*Cape Town. Cape Times, Ltd.*, 1919). *Price* 1s.

The report of the proceedings of the Industries Advisory Board and of the Scientific and Technical Committee, now combined as the Advisory Board of Industry and Science of the Union of South Africa, contains several items of considerable interest. The supply of fertilisers has given a good deal of anxiety, the imports having decreased owing to the shortage of vessels, and although the production of fertilisers from abattoir and fishery waste has been encouraged, very little has really been accomplished. Suggestions were made to the Government to assist financially in carrying out experiments for the conversion of the phosphate rock of Saldanha Bay into basic slag in blast furnaces. This, however, was not considered to be advisable, and it is now reported that the experiments are being carried out by private enterprise. Working scale trials of the "Wolters" process for the treatment of Saldanha rock by heating a mixture of finely crushed rock with bisulphate of soda, carbonate of lime and powdered coke have been carried out in the rotary kilns of the Rand Lime Co. Some loss by dusting and by volatilisation of phosphorus occurred, and, depending on the temperature attained, from 78 to 94 per cent. of the phosphoric acid contained in the raw rock was rendered citric soluble. The Saldanha Company having been taken over by a new company the investigations were discontinued as it was understood that the new company had evolved a satisfactory process and would be in a position to supply the finished product in the new year. Inquiries by the Government as to the possibility of obtaining further supplies of guano from the coast line north of Cape Cross showed that there is no appreciable quantity in sight (*cf.* this J., 1919, 228 R.)

In view of the increasing production of cotton the Board advised the Government to assist financially in the erection of an oil-expressing mill at Rustenburg and the Government is considering the matter. As at the present time the seed is only crushed into cake without extracting the oil, and as the annual import of cottonseed oil amounted to nearly 400,000 gallons before the war, it seems desirable that the oil should be expressed locally.

Proposed legislation dealing with the adulteration of leather with Glauber's salt or sodium sulphate has been under the consideration of the Board and certain recommendations have been made. The control over imported leather should in the opinion of the Board be exercised at the point of entry, and that over locally manufactured material at the seat of manufacture.

In South Africa, owing to the population being spread over a very wide area, the linking up of a system of electric generating stations is not in so favourable position as it is in more populous countries, yet when considering the question of the production and utilisation of electric power due attention should be paid to the standardisation of systems of generation and to the uniformity of frequency and phase of the current generated.

The following recommendations of the Board in regard to industrial alcohol have been accepted by the Government and embodied in the New Customs and Excise Act:—That for manufacturing purposes, other than the preparation of medicinal and perfumery articles, suitably denatured alcohol should be duty free; that a duty of 2s. per gallon should be imposed on alcohol used for the production of medicinal preparations and perfumery, provided that the finished product is unpotable as a beverage, and that alcohol required for scientific and teaching purposes should be obtainable under proper safeguards and restrictions in a pure and un-denatured condition and duty free. Owing to the difficulty of obtaining supplies of wood spirit the Board recommended in a special case that 0·5 per cent. of pyridine should be allowed to be substituted for 2 per cent. of wood naphtha making 1 per cent. of pyridine bases in all, but it is emphasised that this should only be a temporary measure having regard to the very great advantages of wood spirit over every other denaturant in that it was only possible to render alcohol so denatured drinkable at very great trouble and expense. It is further recommended that alcohol intended for the manufacture of ether for industrial purposes other than for medical preparations should, like that destined for the production of acetic acid, be duty free.

As the question of the manufacture of motor spirit by the destructive distillation of coal was occupying the attention of experts in Great Britain it was decided to wait for the result of their investigations before attempting anything locally.

Steps are being taken to prepare and circulate lists of scientific and technical serials and other publications, and to render such literature available in the chief centres of population.

Report on the Trade of Australia for the Year 1918. *By* H.M. Senior Trade Commissioner in Australia. *Pp.* 62. [*Cmd.* 351. 3*d.*] (*London: H.M. Stationery Office.*)

While British manufacturers may confidently anticipate increasing trade with Australia, individual manufacturers may suffer from the revision of the Australian tariff. The urgent necessity for greater attention to commercial organisation is strongly emphasised. The methods of overseas sales and distribution need strengthening, and greater control must be exercised over distribution of goods.

The season's production of sugar amounts to 190,000 tons. The beet sugar industry has made little progress.

So far as possible, all metallic ores are treated within the Commonwealth, and the metals marketed in a refined state. A co-operative

institution exists for smelting silver-lead ores and concentrates, and for refining silver-lead bullion. The output capacity of the works is 160,000 tons of pig lead and 5,000,000 to 6,000,000 ounces of silver per annum. The output of zinc concentrates is controlled and disposed of by an association of the principal zinc-producing companies, founded on a co-operative basis, and with Government representation on the board. For the year ended December 31, 1917, the output of zinc concentrates was 284,662 tons; in 1918 it was 345,017 tons. The annual production of copper is about 40,000 tons. The whole is refined in Australia.

The development of the brown coal deposits in Victoria (this J., 1919, 350 R) and of hydro-electric power (this J., 1918, 260 R) are also described.

The imports of metals and machinery for the year 1913 and for 1917—1918 are given below:—

Year.	Metals.			Machinery.
	Unmanufactured.	Partly manufactured	Manufactured (except machinery).	
	£	£	£	£
1913.	1,575,734	1,500,436	11,781,510	4,841,625
1917-18.	221,030	477 852	5,407,485	2,469,068

The imports of plates and sheets in the same years are given in the following table:—

Plates and Sheets.	Total for 1913.	1917-1918.	
		From United Kingdom.	From United States.
	£	£	£
Corrugated, galvanised	937,114	20,990	276,435
Galvanised, not corrugated, and corrugated, not galvanised ..	1,005,845	182,853	108,497
Plain, not galvanised ..	483,033	26,413	171,919

The value of the imports of earthenware and china from Japan has increased from £21,493 in 1913 to £333,953 in 1917—1918. In the latter year, the values of the principal items were:—

China and porcelain ware, £104,952; earthenware, £51,952; sheet glass, £40,342; glass bottles, £46,795; miscellaneous glass articles, £76,448.

On the whole, the supplies were unsatisfactory. The total "competitive" imports from Japan in 1917—1918 were valued at £4,222,000. In a great many instances the goods supplied were of most inferior quality and not up to sample, and it is anticipated that the bulk of trade created during the war will be lost to Japan.

The Newcastle Steel Works of the Broken Hill Proprietary Co., Ltd. has now an annual output of 250,000 tons of pig-iron. The development of the vast deposits of iron ore and coal occurring in Queensland is contemplated by the State Government.

Paints and varnishes were imported into Australia in 1917—1918 to the value of £423,397, compared with £666,983 in 1916—1917. The principal decrease occurred in paints prepared for use, which were valued at £137,261 in 1917—1918, against £362,941 in 1916—1917.

The gold output of Western Australia for 1917—1918 was valued at £3,723,167, as against £4,121,645 for 1917. Lime and cement works, and glass manufacturing works are being established in the State; the erection of alkali works, the briquetting of coal, and the extraction of oils and varnishes from the abundant grasstree (black boy) are under consideration.

In Tasmania large extensions of the Electrolytic Zinc Company's works at Risdon, on which £250,000 has been already spent, have been decided upon. The Carbide Company now manufactures its own electrodes, the necessary plant having just been erected. Works for the production of lead sulphate using hydro-electric power are being erected in Launceston.

British manufacturers generally are urged to join the Australian Association of British Manufacturers. The address of the London office of the Association is 32, Victoria Street, Westminster, S.W. 1. Inquiries as regards trade with Australia should in general be addressed in the first place to the Department of Overseas Trade (Development and Intelligence), 4, Queen Anne's Gate Buildings, Old Queen Street, S.W. 1.

OFFICIAL TRADE INTELLIGENCE.

(From the Board of Trade Journal for October 9 and 16.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 4, Queen Anne's Gate Buildings, S.W. 1, from firms, agents, or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number:—

Locality of Firm or Agent.	Materials.	Reference Number.
British West Indies	Portland cement	802
,,	Glass, earthenware, leather ..	805
Canada	Sheet metals (black and galvanised), tinplate	789
,,	Druggists' sundries, soap ..	791
,,	Druggists' sundries	796
,,	Drug specialities	797
,,	Soap, soap dyes, gelatin ..	*
,,	Pottery	*
,,	Chemicals, dyes	*
New Zealand ..	Glass, crockery	798
Belgium	Aniline dyes, colours for wool	808
,,	Soap, paint, varnish	810
,,	Chemicals, dyes, caustic potash	862
,,	Perfumery	863
,,	High-speed steel	865
Czecho-Slovakia ..	Chemicals, drugs, dyes, oils ..	868
France	Copper sulphate, fertilisers ..	813
,,	Heavy chemicals, drugs, earthenware, etc.	814 814
Germany	Edible oils, technical oils, seeds, foodstuffs	821
,,	Oils, soap	824
,,	Fatty wastes	825
Italy	Fish oil, vegetable oils, animal oils, sugar, hides, skins, tanning materials	828
,,	Metals, chemicals, dyes, leather, tanning materials	829
,,	Steel of every description ..	832
,,	Soap	871
Rumania	Tinplate	835
,,	Tin plate, black sheets, iron, zinc, salmiac	836
,,	Glassware, crockery	837
Spain	Chemicals	838
,,	Chemicals and pharmaceutical products	840
,,	Druggists' goods	842
,,	Chemical and pharmaceutical products, dyes, paints, varnish, perfumes	874
Swirzerland ..	Chemicals, metals	876
Brazil	Paint, varnish, china, earthenware	878
Cuba	Chemicals, drugs, glass, perfumes	848
Dominican Republic	Paint, zinc plates	849

* The Canadian Government Trade Commissioner, 73, Basinghall Street, London, E.C. 2.

Markets Sought.

A Canadian firm manufacturing a synthetic drug desires to appoint a suitable agent in the U.K. Inquiries to the Canadian Government Trade Commissioner as above.

A Montreal firm seeks a purchaser for a graphite property in the Province of Quebec. Inquiries to the High Commissioner for Canada, 19, Victoria Street, London, S.W. 1.

A firm in Cuba desires to get into touch with U.K. importers of sugar. [Ref. No. 848.]

TARIFF. CUSTOMS. EXCISE.

Australia.—Recent customs decisions affect thermometers and pyrometers.

Belgium.—The import and excise duties on alcoholic liquors have been greatly increased as from August 29.

Certificates of origin and interest are no longer required for asphalt, cork, ore, and wine imported from Spain.

The import and manufacture of matches containing white phosphorus are prohibited as from March 14, 1920, and the sale of such matches as from September 14, 1920.

Among the articles for which export licences are no longer required are colours, glycerin, gums, lime, olein, phosphates, resin, rubber (crude), turpentine, varnish, and window glass.

British India.—An export duty of 15 per cent. *ad valorem* has been imposed on raw hides and skins, with a rebate of two-thirds of the duty when exported to countries within the Empire.

Denmark.—Export prohibitions have been withdrawn in the case of phosphoric acid, agar-agar, medicinal balsams, barks, leaves, roots, seeds and gums, candles, cellophan, celluloid, cresol, drugs (with some exceptions), dyes, magnesite, mica, paper, paraffin, platinum, polishing wax, vulcanised fibres, and wood (with some exceptions).

Finland.—A copy of the new customs tariff may be seen at the Department. Among the articles the import of which is now unrestricted are animal fats and oils, many foods, chicory root, oilcakes, condensed and dried milk, cocoa, molasses, timber, cork, fibres, paper, hides, skins, glue stock, leather, rubber, gutta-percha, balata, iron, iron alloys, aluminium and its alloys, lead and its alloys, asbestos, certain minerals, lime, clay, ores of all kinds, glass, mineral oil, asphalt, coal tar and its distillates, varnish, waxes, colours, paints, dyes, and many chemicals.

France.—The agreement between the British and French Governments respecting the application of the French import restrictions to goods of U.K. origin and of the U.K. restrictions to French goods has been denounced and will terminate on Oct. 27.

A copy of the decree regulating the customs *régime* for petroleum products may be seen at the Department of Overseas Trade. The decree defines "gas oil," "fuel oil," "rood oil," petroleum pitch, petroleum coke, and other products, and indicates the appropriate rates of duty. Other provisions relate to the control to be exercised over factories, the marking of the containers, the warehousing of the products, and the conditions under which residues for marine engines are exempt from duty.

France and Algeria.—The customs duties on certain kinds of iron and steel tubes are not subject to the "coefficient of increase" established by the decree of July 8, and the rates of duty thereon are those laid down in the tariff.

French West Africa.—The total prohibition of the import of all alcohol and spirits came into force on October 1.

Italy.—Explosives may now be imported freely from the U.K.

Jamaica.—The import surtax on spirits and wines has been increased to 37½ per cent.

The following export duties are in force until March 31, 1920: Coconuts, per 1000, 2s.; hides of cattle—dry or dry salted, per 100 lb., 4s.; green or wet salted, per 100 lb., 2s.; logwood extracts, liquid or solid, on every ton of solid extract therein, £10.

Among the articles subject to the new package tax are bricks, tiles, slates, ironware, pewter, copper, lead, tin, brass, and paint.

Mexico.—Recent customs decisions affect lard, china, porcelain, rubber, and magnesite.

Morocco (French Zone).—A consumption tax has been imposed on certain articles of "colonial produce" and their substitutes as from August 25.

Paraguay.—The export duty on quebracho extract has been raised to 5 dollars (gold) per metric ton, as from August 16.

South Africa.—Recent customs decisions affect bronze foil, Silician Earth, and vegetable black.

South Russia.—No goods may be exported without licence from the Department of Trade and Industry of General Denikin's Government.

United States.—It is proposed to amend the import duties on zinc ores and manufactures thereof, crude manganese ores, manganese concentrates, ferro-manganese, and spiegeleisen. The proposed rates of duty are set out in the issue of the *Board of Trade J.*, for Oct. 9.

GOVERNMENT ORDERS AND NOTICES.

PROHIBITED EXPORTS.

Deleted Headings.—The following goods have been removed from List A:—Mustard seed; cottonseed oil; oleo; sesame oil; lard, imitation (compound); lard, neutral; all edible oils (except coconut oil, groundnut oil and palm kernel oil, for which licences are still required).

An open general licence has been issued for the export of manufactured whalebone to all destinations.

NEW ORDERS.

Articles Scheduled under the Profiteering Act, 1919.—The Board of Trade has issued an Order, under date October 14, by which the following articles, *inter alia*, come within the scope of the Act:—F. All drugs (excluding quinine sulphate which is controlled), and medicinal powders, including tooth powders, talcum powders and Fuller's earth. G. Medical and surgical appliances and dressings, including thermometers. H. All articles used for fuel and lighting (except coal), including:—Candles, lamp oils, kerosene, petroleum, paraffin, firewood and fire-lighters, methylated spirit, and matches. J. Weights, measures, weighing instruments and measuring instruments.

Maximum Prices of Petrol.—The Profiteering Act, 1919, Maximum Prices Order (No. 2) (this J., 1919, 381 R) was revoked on October 14.

The Flax Seed (Ireland) Suspension Order, 1919.—Under this Order, made by the Minister of Munitions on October 21, the following Orders are revoked:—The Flax Seed (Ireland) Order, 1918; The Sale of Flax Seed (Ireland) Order, 1918; The Flax Seed (Shipment from Ireland) Order, 1918.

Merchandise Marks Committee.—The President of the Board of Trade has appointed a committee to consider:—

1. Whether any extension or amendment of the Merchandise Marks Act is required in respect of the provisions relating to indications of origin:

2. The utility and effect of national trade marks or other similar (collective) marks, and how far they should be authorised or encouraged in this country; 3. How far further international action may be necessary for the purpose of preventing the false marking of goods.

Sixteen appointments to the committee have been made. The chairman is Mr. H. Green, M.P., and the secretary, Mr. M. F. Levey of the Industrial Property Department of the Board of Trade (address: Patent Office, 25, Southampton Buildings, W.C. 2).

COMPANY NEWS.

THE EASTERN CHEMICAL CO., LTD.

The sixth ordinary general meeting was held in London on September 26. The chairman of the company, Mr. H. N. Morris, in moving the adoption of the report and accounts, stated that the gross profit for the year ended March 31 last was £25,094, and the net profit £13,842. Out of the available balance of £21,719 it is proposed to pay a dividend of 10 per cent. on the ordinary shares, leaving £16,631 to be carried forward, from which sum income and excess profits taxes, estimated at £9000, will have to be deducted. The issued share capital remains unchanged at £73,695, but the balance of £26,305 has been offered in £1 ordinary shares to the shareholders at 30s. per share, and the issue has been over-subscribed. It is proposed to convert the 2s. deferred shares into ordinary shares on the basis of one of the former for two of the latter; this will involve raising the nominal capital by £19,000. Various extensions have been made to the company's works; the caustic soda plant, erected to meet the requirements of the Anglo-Persian Oil Co., has been completed, and additions have been made to the copperas, nitric acid, and hydrochloric acid plants. Limekilns have also been built and brought into operation. The directors have adopted a comprehensive plan of development and intend to carry it out gradually. Some of the proposed extensions will necessitate the erection of new works in India. The scheme of development referred to at the last annual meeting will be held up until some action has been taken to give effect to the recommendations of the Indian Industrial Commission.

UNITED INDIGO AND CHEMICAL CO., LTD.

During the year ended June 30, 1919, the trading profit of £63,907 constituted a record; the net profit of £50.271 was slightly lower owing to increased war taxation in America. The issued capital is £95,000. Dividends of 20 per cent. for the year have been paid on both preference and ordinary shares. £3001 goes to the directors as a special bonus, and £43,321 is carried forward. The chairman, Mr. G. Heywood, at the annual meeting held in Manchester on September 26, said the company's works on both sides of the Atlantic had been fully employed. Conditions generally are not too favourable, and it would be unwise to rely upon the maintenance of recent profits.

ODAMS' NITRO-PHOSPHATE AND CHEMICAL CO., LTD.

At the sixty-seventh ordinary general meeting, held in London on October 1, Mr. F. Richardson, deputy chairman, said that the company had made a gross profit of £24,958 in the year ended June 30, 1919, which was £8761 more than in the previous year, and a net profit of £11,546 (capital £45,000, debentures and mortgage £43,500). The directors proposed to place £1500 to reserve, to pay a 15 per cent. dividend and to carry forward £4784. Trade had been better during the financial year, more labour had been available, and, except towards the end of the season, the supply of raw materials was satisfactory.

Mr. F. B. Lacy (managing director) said the main trouble had been with labour. Since June 30 last arrangements had been made with Allied manufacturers for combined purchases, and these were working satisfactorily. Raw phosphate was in short supply because the French Government had deprived the phosphate mines of much of their plant, and the mines in Florida had been closed since May last owing to strikes. The world's supply of phosphate would be very considerably reduced.

TRADE NOTES.

FOREIGN.

Menthol and Peppermint Market in Japan.—The menthol and peppermint market has become somewhat dull, but prices still stand at a strikingly high level. Exports have also become somewhat sluggish. Last season more than 650,000 kin (kin = 1·33 lb.) of menthol and peppermint was exported, the largest buyer being England, the second the United States, and the third Russia. The average prices per kin were 7 yen (yen = 2s. 0½d.) for menthol crystals and 2 yen for peppermint oil. Before the war the exports amounted to 350,000—400,000 kin. Germany was then the largest buyer, England was second, and the United States very low in the list. The pre-war average prices were 6·50 yen per kin for menthol crystals and 3 yen per kin for peppermint oil. At present the prices of 16·50 and 4 yen per kin (25s. and 6s. per lb.), respectively, are too high to tempt foreign purchasers.—(Tokyo, Sept., 1919.)

Shortage of Fertilisers in Spain.—Spain needs fertilisers, particularly for rice cultivation around Valencia. The annual consumption of sulphate of ammonia is from 60.000 to 70,000 tons; 100,000 tons of phosphates is imported annually from Florida and 200,000 tons from Algiers; whilst Spain produces from 16.000 to 18,000 tons of low grade phosphate. All this phosphate is converted into superphosphate, the Government prices for which are: 13—15 , phosphoric acid 16·85 pesetas per 100 kilo. (6s. 1d. per 100 lb.) at the manufacturing plant; 15—17 19·95 pesetas (7s. 2d. per 100 lb.), 16—18 21·50 pesetas (7s. 9d. per 100 lb), 18—20 27·25 pesetas (9s. 9d. per 100 lb.).—(*U.S. Com. Rep.*, *Sept.* 9, 1919.)

Exports of Vermilion from Hongkong.—The manufacture of vermilion in Hongkong, interfered with by the war, is now being revived. Mercury comes from China, whither most of it returns as vermilion. The product is exported in cases containing 900 packages of about 1·4 oz. each. The present price is about 3s. 4d. per lb., which is considered very low.—(*U.S. Com. Rep.*, *Sept.* 9, 1919.)

Chinese Tungsten Ore and the American Market.—The normal demand for tungsten ore in the United States in the pre-war period was about 2.000 tons per annum, and during the war this demand increased to about 7,500 tons, which is the estimated production in South China for 1918. The pre-war demand was almost wholly supplied by American mines, and after the war demand for tungsten began to be felt it was possible, by extending workings, to increase the American supply to about 5,300 tons. The high price which resulted from the shortage of the American supply caused increased developments in China, where it was found that tungsten ores were much more accessible than in American fields, and that they could be landed in American ports, even with excessive freight charges, at prices with which American ores could not compete. The low wages in the Chinese mines was an important factor in this situation.

The natural result of this condition was a remarkable exploitation of the tungsten mining areas of South China; but with the armistice came a temporary lull in the American market for Chinese tungsten. The abnormally high prices which prevailed during the war suffered a decided decline, which was immediately reflected in the lessened avidity with which the small Chinese miners sought the ores. It is now generally conceded, however, that Chinese ore can be marketed in America in normal times at good profits in competition with domestic ore; and the Chinese industry is therefore gradually assuming permanent proportions.

An interesting feature disclosed by the American Government statistics is that, with a war demand estimated at 7,500 tons, the United States imported in 1918 a total of 10,362 tons valued at $11,409,237. This was due to the fact that many users of tungsten were encouraged to stock up heavily with ore while there was more or less uncertainty as to the time when the European conflict would end. The results of heavy overstocking were a fall in the American market and the temporary collapse of the industry in China in the closing months of 1918, affecting most heavily the exporters and middlemen. In order to tide over the effect of this overstocking, plans were on foot to erect smelters in China where the ore may be treated and offered in markets which furnish a steady demand for the finished product. It is believed that it should be to the greatest advantage of American manufacturers, whose products are affected by the price of high-speed steel, to continue to draw from the Chinese market. This will not only give their products a lower price in world competition, but will encourage export trade with China by furnishing return cargo. On the other hand, it is argued that by encouraging the importation of Chinese tungsten an American mining industry of vital importance in time of war would receive a very serious if not fatal set-back (cf. this J., 1919, 248 R, 382 R).—(*U.S. Com. Rep., Aug.* 21, 1919.)

The Leipzig Fair, 1919.—According to advices received from Germany about 10,000 firms, mostly German, took part in this exhibition; the attendance was the record one of 118,000, and the number of foreign buyers present was 7,000. Whilst the will to work and to recover prosperity was conspicuous, the general impression created was that German industry as a whole is in a precarious condition, owing mainly to lack of fuel, but also to inability to purchase foreign raw materials through the low exchange value of the mark. German traders appear to think that it will be easier to re-establish relations with America and neutrals than with Great Britain.

From the standpoint of export, the technical section, including new machine tools, mechanical and electrical goods, was probably the most important, for considerable stocks are on hand. The machinery exhibited was of first-class order, but brass was conspicuously absent. There was an abundance of specialised new machinery, and many firms were anxious to dispose of their patent rights to foreign buyers. Orders were also very plentiful for porcelain and crockery ware, but most of the factories were closed down through lack of coal. The production of aluminium does not exceed 10% of the total output capacity of 4,000 tons per month, and most of the German, American, and Dutch buyers of aluminium ware will have to wait many months for delivery. In the section of constructional materials many substitutes for Portland cement were observed, and also much artificial marble (from gypsum). The exhibits of textiles were poor, and the prices of the multitudinous paper textiles were double the pre-war prices of the genuine articles.

REVIEWS.

Methoden van Onderzoek der bij de Java Rietsuiker-industrie Voorkomende Producten. [Methods for the Examination of Products Occurring in the Java Cane Sugar Industry.] *By H. A. P. M. Tervooren and H. C. Prinsen Geerligs. Pp. xvi. + 376. Fourth edition. (Amsterdam: J. H. de Bussy, 1919.) Price: 7.50 florins (12s. 6d.)*

In the modern sugar factory the chemist takes the part of a technical accountant, the commodity for which at every stage of the process of manufacture he is responsible being the sucrose entering with the cane and leaving in the form of sugars and waste products (as bagasse, filter-press cake, and molasses). He practises a rigorous system of chemical control; and this demands, not only the exact sampling and analysis of the several products, but also the application of an elaborate system of compiling and collating results.

It is perhaps in Java that chemical control at the present day has reached its highest development. In that colony there are about 140 factories, *all* of which conform to a standard scheme for the elaboration of data under the general supervision of the director of the Experiment Station. It is recognised that it is largely owing to this thorough system of "mutual chemical control" that Java, in spite of difficulties and disadvantages, has for some years past held a foremost position in the sugar world.

This volume is the text-book issued under the auspices of the Java Experiment Station for the use of the Dutch sugar factory chemist in effecting chemical control. Three previous editions have been published under the authorship of Mr. Tervooren, while the revision of the present one has been entrusted to the well-known technologist, Dr. Prinsen Geerligs. It is divided into three parts, dealing successively with (1) general methods for the determination of sucrose, reducing sugars, ash, dry substance, and purity coefficients; (2) the sampling and analysis of the products of the factory, from the cane to sugars and molasses; and (3) methods for the examination of materials used in manufacture, as lime and limestone, sulphur, hydrosulphites, ultramarine, etc. Dr. Geerligs' revision of Mr. Tervooren's text has not been extensive, being chiefly confined to some elaboration in the sections dealing with the determination of sucrose and reducing sugars, and to the methods used in the sampling and the analysis of cane, bagasse, and raw and clarified juices.

For the greater part, the "Handboek" prescribes only well-approved methods that are in use also in other countries, either as such or with only slight variation. It is of interest, however, to note that certain methods differing from those generally adopted are now included in this edition. For example, in the determination of sucrose it is stated that one may obtain good results with Steuerwald's process of double polarisation, in which hydrolysis in the presence of hydrochloric acid is effected by standing for 2—3 hours at the temperature of the tropical laboratory, instead of heating to 68—70° C. for 5 minutes, as specified by Herzfeld; but it is well to note when using this modification that as the amount of hydrochloric acid necessary for inversion under these conditions is double that generally added, an appreciable error may be produced owing to the effect of the excess of acid upon the rotation of the lævulose. When, therefore, the reducing sugars are high (as in the case of molasses) it is advisable to adhere to the ordinary Clerget-Herzfeld procedure. It is now generally recognised that in making the direct reading in the double polarisation method the influence of the basic lead

acetate used in clarification upon the lævulose of the reducing sugars must also be corrected in some way; and in Java this is done by the addition of 1 c.c. of acetic acid (30%) to 100 c.c. of the clarified liquid. Another new method for the determination of sucrose here described is that elaborated by Muller, in which the reducing sugars are destroyed by oxidation, and the polarisation assumed to indicate the sugar present. It may be convenient to follow this process for rapid routine determinations; but it should be borne in mind, as Löhr has pointed out, that the dilution necessitated by the volume of oxidising agent and clarifying solution required is such as to render the result only approximate. Regarding the determination of reducing sugars, as a more rapid alternative to the gravimetric method, Dr. Geerligs recommends the volumetric procedure generally known as Bertrand's, in which the cuprous oxide is dissolved in a solution of ferric salt, and the reduction determined by permanganate. Lastly, it may be mentioned that the method now always employed in Java for the determination of the true dry substance of juices, syrups, and molasses is that in which a solution of the product is absorbed by a coil of bibulous paper placed in a special dish, and desiccation carried out for about four hours at a temperature of 102°—105° C.

This book can confidently be recommended as a reliable manual of modern chemical control in the cane sugar factory. It describes the various methods in an admirably clear and precise manner; it is adequately illustrated; and it gives frequent references to facilitate the consultation of original papers. We express the hope that before long a similar handbook may exist in the English language for the use of British chemists in practising a system of *mutual* chemical control in the several sugar-producing parts of the Empire.

J. P. Ogilvie.

OBITUARY.

J. C. UMNEY.

In John Charles Umney, pharmaceutical chemistry loses a distinguished and prolific worker, and the wholesale drug trade one of its outstanding personalities. The deceased was educated at Dulwich College and trained in pharmacy by the late William Martindale, and at the School of Pharmacy in Bloomsbury Square, where he was subsequently engaged in the Research Laboratory. Later he entered the firm of Wright, Layman and Umney, Ltd., and become a partner and managing director.

J. C. Umney was the author of a very large number of contributions to the Pharmaceutical Society, the British Pharmaceutical Conference, of which he was president in 1913, and to other bodies. His activities were very widespread, and in 1910 he founded *The Perfumery and Essential Oil Record*. He contributed the article on essential oils to the last edition of Thorpe's "Dictionary of Chemistry," and was chosen, with Prof. W. H. Perkin and Sir Wm. A. Tilden, as one of the Fairchild post-graduate lecturers in 1912. His connexion with the Society of Chemical Industry dated from 1905, and it is of interest to recall that he lent his valuable assistance to the late Mr. Thomas Tyrer in his struggle to obtain duty-free alcohol for manufacturing purposes.

PUBLICATIONS RECEIVED.

Asphalts and Allied Substanes. *Their occurrence, modes of production, uses in the arts and methods of testing. By* H. Abraham. *Pp.* 606, *with* 208 *illustrations. (London: Crosby, Lockwood and Son.) Price 25s.*

The Nature of Enzyme Action. *By* W. M. Bayliss. *Monographs on Biochemistry, edited by R. H. A. Plimmer and F. G. Hopkins. Fourth edition. Pp.* 190. *(London: Longmans, Green and Co.* 1919.) *Price 7s. 6d.*

Stereochemistry. *By* A. W. Stewart. *Second Edition. Text-books of Physical Chemistry. Edited by Sir William Ramsay.* Pp. 277. *(London: Longmans, Green and Co.,* 1919.) *Price 12s. 6d.*

Sewage Disposal. *By L. C.* Kinnicutt, C.-E. A. Winslow *and* R. W. Pratt. *Second edition, rewritten, Pp.* 547. *(New York: Jn. Wiley and Sons, Inc. London: Chapman and Hall, Ltd.* 1919.) *Price 18s. 6d.*

The Condensed Chemical Dictionary. *A reference volume for all requiring quick access to a large amount of essential data regarding chemicals, and other substances used in manufacturing and laboratory work. Compiled and edited by the Editorial Staff of the Chemical Engineering Catalog. Pp.* 525. *(New York: The Chemical Catalog Co., Inc.* 1919.) *Price $5. (Bound in flexible leather-cloth cover and with thumb-index, $6.)*

The Canada Year Book, 1918. *Compiled by the Dominion Bureau of Statistics, Canada. Pp.* 686. *(Ottawa: J. de Labroquerie Tache.* 1919.)

Publications of the United States Bureau of Mines, Department of the Interior. *(Washington: Government Printing Office.* 1919.)

Fume and Other Losses in Condensing Quicksilver from Furnace Gases. *By* L. H. Duschak *and* C. W. Schuette. *Price 5 cents.*

Labour Saving at Limestone Quarries. *By* O. Bowles. *Price 5 cents.*

Saving Coal in Steam Power Plants. *Reprint of Engineering Bulletin No. 2.*

Publications of the United States Geological Survey. Department of the Interior. *(Washington: Government Printing Office.* 1919.)

Prices of Coal and Coke. 1913—1918. *By* C. E. Lesher.

Fuller's Earth in 1918. *By* J. Middleton.

Salt, Bromine, and Calcium Chloride in 1918. *By* R. W. Stone.

Magnesite in 1918. *By* C. G. Yale *and* R. W. Stone.

Tin in 1918. *By* A. Knopf.

Natural Gas and Natural-Gas Gasoline in 1917. *By* J. D. Northrop.

Coke and By-Products in 1916 and 1917.

Coal in 1917. Part A. Production. *By* C. E. Lesher.

Catalogue on Rare Books on Exact and Applied Science. *No.* 773. *Pp.* 256. *(London: H. Sotheran and Co.* 1919.) *Price 2s. 6d.*

THE SALE OF GAS ON THE BASIS OF ITS HEATING VALUE.

This proposition is one which has recently come to the fore, and will probably play a leading part in the schemes of reconstruction in the gas industry. In the early part of the year, Dr. Charles Carpenter, Chairman of The South Metropolitan Gas Company, proposed methods for putting the idea into operation, and showed that the sale of gas on a heat basis was not only a practical suggestion, but one which could be carried out very readily without involving a great expenditure of money or labour. Later the innovation received renewed attention from members of the industry when it was learned that the charging of gas on a thermal basis constituted one of the recommendations of the Fuel Research Board in its report on gas standards.

There are apparently various reasons why the present time is considered opportune for the introduction of this new system of charging. During the war both industrial and domestic consumers appear to have suffered considerable inconvenience through the relaxation of the legal standards of gas and the consequent delivery of a quality unsuited for consumption in existing appliances. Moreover, the quality of the gas varied from time to time, and hence, in industrial processes, it was often found impossible to exercise the fullest control over the operations involved. It is felt that the confidence of the gas consumer, which has without doubt been lost to some extent during the war period, will be regained by the introduction of this new system, which does not merely involve the sale of gas on the basis of its thermal value, but also the delivery of gas of a constant calorific power. Further, in view of the fact that it is essential to produce gas on the most economical basis, not only in the interests of industry, but also to conserve the coal resources of the kingdom, it is believed that the introduction of this new system will constitute a means of augmenting carbonising efficiency and, generally, of stimulating progress. Finally, it has been considered advantageous to introduce this system in order to establish a common basis for comparison with electricity, so as to enable the consumer to compare financially the two forms of energy.

In the practical consideration of the scheme by Dr. Carpenter, he has suggested that 100,000 B.Th.U. should represent the standard gas unit. Doubtless a distinct advantage would be gained by the adoption of a unit comparable to the heating value of a Board of Trade electrical unit, *i.e.*, to 3418 B.Th.U., but this apparently presents difficulties. In the first place, owing to the economic superiority of gas over electricity small alterations in the price of gas could only be expressed in very small fractions or decimal parts, and, further, arithmetical complications would be introduced in a system of charging based on a unit of 3418 B.Th.U. With regard to the latter point, it is obvious that if it were adopted the calculation arising from the conversion of cubic feet to standard gas units would be, in the case of a consumption of, say, 57,000 cu. ft. of 480 B.Th.U. gas $= \frac{57{,}000 \times 480}{3418}$

If, however, the suggested unit of 100,000 B.Th.U. be adopted, the calculation involved would be $\frac{57{,}000 \times 480}{100{,}000}$. In actual practice this calculation would be considerably simplified, as the conversion can be directly accomplished by multiplying the meter reading (expressed in hundreds of cubic feet) by the calorific value, and moving the decimal point three places to the left in the resulting product. In the scheme outlined it is suggested that the consumer's meter card should record indexes and consumption in hundreds of cubic feet as now, but should have in addition a multiple or factor for conversion, which would be the figure for the calorific value of the gas supplied. It is thus obvious that by adopting the larger unit, difficulties of computation are reduced to a minimum. Similar methods are applicable in dealing with the slot meter consumer under this scheme, the additional charge for fittings and hire being made per standard gas unit instead of per one thousand cubic feet. In Dr. Carpenter's communication to the *Gas World* of March 15, 1919, tables are given showing the relations between price per standard unit and price per thousand cubic feet of gas varying in calorific value from 300 to 600 B.Th.U., together with a table of charges for fittings and hire for slot meter consumers. There is no doubt but that the practical application of the scheme has received detailed consideration by Dr. Carpenter, who is definitely of the opinion that the alteration to the new basis of charge is one which presents no difficulties, and is capable of being carried into operation within a short space of time.

The new basis of charging when first proposed was not well received by the gas industry, although no serious criticisms have been advanced against the proposition. There is little doubt but that the advantages accruing from the stabilising of the industry on a more business-like and scientific footing will far outweigh any disadvantages arising in connexion with the change over to the proposed system. In the first place, although the thermal efficiency of the gas-making processes are acknowledged to be relatively high, it is believed that the production of heat units instead of cubic feet per ton of coal will cause greater attention to be paid to various factors which have been neglected by the gas engineer in the past. This will naturally result in a marked improvement in the efficiency of his carbonising processes. He will be presented with new problems, such as the relative economy of distributing a large volume of low calorific power gas or a smaller volume of gas of high calorific power. Such questions as the purification, storage. and delivery of the larger or smaller bulks involved will constitute important factors in determining the policy of gas undertakings. Among other consequences the operation of the suggested scheme will result in the more general distribution of gas containing a lower proportion of inert constituents, and thus lead to the general distribution of gas of a higher calorific value. The quality of the gas to be supplied will, however, be a question to be decided by each undertaking, and will doubtless be such as will enable the undertaking to work with the highest economy and efficiency, the standard of efficiency being the optimum production of B.Th.U. per ton of coal at the minimum cost.

It will be generally agreed that this system of charging, being based as it is on the intrinsic value of the gas, must tend to operate directly in the interests of the consumer. To effect this completely, however, means must be devised to ensure that his charge is based on the potential thermal units in the gas supplied, and that these thermal units are delivered in the form of gas of constant calorific power. It is, therefore, necessary to provide some reliable form of recording gas calorimeter and to establish an organisation for the continuous control of the gas distributed.

The increasing importance of town gas supply is becoming more and more evident, both on the score of conserving our fuel resources and providing a higher standard of health and comfort in our cities. In industry also its usefulness is rapidly growing, and manufacturers are likely to welcome

not less than the general public the relief from annoyances and inconveniences, too numerous during war conditions, which the new proposals seem certain to bring about.

NOTES ON THE RHINELAND CHEMICAL WORKS.*

J. ALLAN.

Part I.—Main Factors in the Development of the German Chemical Industry.

The time is opportune for us to take stock of our position in the world of chemical manufacture, and an important factor in determining our status must necessarily be the value which we place upon the German chemical industry, the heart of which undoubtedly is located in the valley of the Rhine. Much has been written, and even more said, of the greatness of the chemical works in this area and of the marvellous efficiency of their management. It has never been an attribute of the Germans to belittle themselves or their possessions, and many of the statements made as to the marvels of the country, of the wonders of its factories, and the ability of its people are their own assertions, varied merely by the language in which they are expressed. I do not wish it to be assumed from this statement that there is nothing great in what they have done in the business of applied chemistry, far from it, but I desire to assert that they have no monopoly in the ability necessary to initiate such enterprises and bring them to fruition. Many circumstances have contributed to the enviable position which they now hold in the domain of applied organic chemistry, and we can learn much from a full consideration of some of them, especially with the fuller knowledge which has been acquired and the new perspective which has been created by the many happenings of the past five years. Not the least important of these has been the occupation of the Rhineland areas by the Allied forces, and their presence has made it possible for a survey to be made of practically all of the works within the occupied region under conditions which never previously occurred, and in a small measure to penetrate the wall of secrecy which has for long surrounded them. It is with the view of conveying to you some impressions of a visit to the occupied areas that the subject of this address has been chosen.

The present position of the German chemical industry is the outcome of a variety of causes, and not the least of these is the peculiar combination of natural advantages which arise from the possession by Germany of the Rhine valley and those of its tributary streams. Along the two hundred miles of its navigable length in German territory the greatest of its chemical works are situated. The river provides at once a means of transport for raw and finished products both internal and seaborne, a supply of water for all kinds of technical operations, and a ready means of disposing of effluent, whilst in close proximity to the water front are to be found the great beds of brown-coal which supply fuel at a cost which is almost nominal. The supply of this cheap fuel is only one of the natural resources of this favoured part of Germany, since coal, lime, salt and pyrites are all available within the transport area. These are natural assets, and they have been greatly added to by a network of broad- and narrow-gauge railways which have been laid down wherever there is need, and which are operated under conditions which make their use peculiarly favourable to manufacturers within the districts which they serve.

* Chairman's Address to the Manchester Section on October 3.

The mere possession of such facilities, however, does not make an industry, and a glance at the story of the growth of their chemical industry will indicate at once that this is so. The manufacture of the so-called heavy chemicals is the oldest branch of applied chemistry, and in this Britain has for a long time taken a leading place. As a "large" industry both in the home trade and for export, alkali and acid manufacture and the production of articles of trade in which these substances are employed had been in British hands for many years before Germany became a manufacturing nation. It was natural that the development of chemical manufacture in Germany should be along the line of least resistance offered by the field of organic chemistry, a line indicated by Perkin's discovery of aniline-purple or mauve in 1856, followed by the production of aniline-red or magenta by Vergius in 1859. I mention these years, familiar enough as they are, in order that more emphasis may be given to the fact that within a very few years after them the foundations of the greatest German firms were laid. Bayer & Co., Meister, Lucius & Brüning, Kalle & Co., and the Chem. Fabrik Griesheim were all founded in 1863, whilst the Badische Anilin- und Sodafabrik was started in 1865.

Nothing in their small beginnings could indicate how rapid would be their growth, and how small these beginnings were is shown by the fact that Meister, Lucius & Brüning, which, as the Farbwerke Höchst, employed in 1914 about 8,000 workmen and over 300 chemists, found its work efficiently carried out in 1863 by the five workmen it then employed.

It is to be noted also that the men required to carry on the work of developing these concerns were already trained and at hand. The importance of the field of organic chemistry had already been estimated by such chemists as Liebig, Wöhler, Kekulé and others, and their students were ready for the work required of them in the new factories. The advance was rapid, and the training of new men in the principles of research became an integral part of their university career. But there was more than opportunity to induce young men to embrace a scientific career. It was thought fitting for members of the best families in the country to take up the study of applied science, and honours and high positions were awarded to those who attained to eminence in it. The effect of such increased opportunities for study and the honours bestowed upon successful students inevitably created an extraordinarily large supply of trained men, with the result that salaries were always low, and firms could afford to select only the cream of the applicants that were always present in numbers whenever a vacancy in their staffs occurred.

The law of supply and demand should have operated to check this fulness in the market of trained intellects, but another and powerful stimulus began to make itself felt, a stimulus which still retained the attraction of recognised status in society, so dear to the German, and yet saved them in large measure from the necessity of undergoing the full term of three years' military training which it was necessary by law that the whole youth of Germany should undergo. A scientific examination or a certificate of maturity or educational efficiency obtained from a recognised school or university was accepted as a reason for the reduction of this period of service to that of one year only in the class of so-called volunteers. This service could be taken in any troop, the volunteer being trained for the position of an officer in the reserve, in which class he had all the status which is accorded to a member of the officer class, with only short periods of training yearly which reduced the hardship of military service to a minimum. Under these conditions,

as well as by the national recognition of scientific attainments, the supply of highly-trained men was always in excess of the demand.

The German chemical firms were, like most of our own, begun by chemists, and it is to be noted that those that are great to-day have still prominent men in their direction whose training and habit of mind is essentially scientific, many of whom have been drawn from the class of professors and *privatdocenten* whose worth had already been proved by the close touch which has always been maintained between the factory and the university. I need not go into the detail of this association as it must be familiar to all; its value as a commercial asset needs no argument.

It was in the two great branches of industrial organic chemistry, dyes and fine organic chemicals, that the effect of this application of science to manufacture was most evident, resulting ultimately in a virtual world-monopoly of these products. It is a peculiarity of such manufacture that the manufactured articles are extremely numerous and produced in comparatively small quantities, the result being that small businesses have little chance in competition with larger firms unless they be concerned in the manufacture of highly-specialised articles in the sale of which the profits are relatively large. The prominent firms in the business became great, and their growth provided them with still more powerful weapons to withstand any attack from new commercial rivals, whether of their own or foreign nationality. As in all industry, increased production means reduced working costs and consequently enhanced profits; the ever-growing output from these works resulted in competition of the severest kind, and internal working arrangements between firms were soon come to whereby group competed with group instead of firm with firm. The most notable of these amalgamations was tho formation in 1904 of the two great groups which included the Badische, Bayer and Berlin firms on the one hand, and the Höchst, Casella and Kalle companies on the other.

These associations, as was inevitable, gradually came more and more together until in 1916 the Erweiterte Interessen-Gemeinschaft was formed, which involved in its composition besides the above group such firms as Griesheim Elektron and Weiler-ter-Meer, which had previously been in the outer circle of these associations, and many others whose businesses were more concerned with the supply of plant and materials rather than the actual manufacture of chemicals, as was the case with the members of the earlier groups. Of the methods adopted to stamp out competition I shall say nothing here. They were of the most ruthless kind, and by many asserted to be absolutely dishonest. It is of course arguable as to when business policy and tactics cross the line between fair and unfair dealing, but in any cases these associations left no stone unturned to eliminate all interference with their business, and no newcomer was tolerated either in their own or other lands.

It is in no way clear when the German Government first realised how huge was the national asset that was growing up in the country, but once this realisation was arrived at the industry was fostered and supported in no half-hearted fashion by the imposition of import tariffs and the granting of exceptional facilities for carrying on export trade, and, it is said, also by financial arrangements through the large national banks. It has been said that each of these great factories is a "potential arsenal," but how great that potentiality is was not realised, at least by other nations, until the happenings of the last five years established it in no doubtful fashion. In the face of such facts as have been established, no nation in the world, if it values its permanence, can afford to ignore the fact that the position of its chemical industry is the foundation upon which the whole fabric of its being is built up. If that foundation be ignored, the structure is unstable so long as force of arms is left as the means of settling international disputes or may be employed as a means to satisfy a nation's avarice.

It is frequently stated that the facilities offered to manufacturing concerns by the German banks are much greater than can be obtained from English banking institutions, but it is seldom that one can find a statement of the essential difference between the practice in this respect of the banks of the two countries. It may be useful, therefore, to indicate briefly what the German system is, and to show how its application has affected the growth, not only of the chemical, but of all German industries. Essentially our banks concern themselves with investments or the financing of short term loans on the most easily realisable security, and though it is possible to obtain loans on collateral securities from them, these must always be of the most easily realisable character, and business overdrafts are always covered by raw or finished goods in which there is an open market. This arises essentially from the fact that the greatest proportion of the banking business is carried out on monies deposited with the bank and not with the actual subscribed capital of the bank itself, and consequently liquidity of investments is essential to security. The position in the case of German banks is markedly different from this. It is to be noted at the outset that the *cartel* system is as prominent in German banking as it is in industry, even the largest of the banking concerns working in groups to their mutual advantage.

These groups further organise themselves into sections to deal with special types of financial propositions which may be concerned with countries or industries, and large group will work in association with large group in order to handle specially large loans, their practice here being similar to that of the spread of large risks by fire insurance companies. It might be said here that such a system cannot be so safe as that of the English banks, and for our banks the risks would certainly be too great to carry, but the capital of the German banks is so much greater in proportion to their liabilities than is the case in England that their practice is as sound as our own. Whereas some of our largest banks show a proportion of capital to liabilities of only 5 per cent., the ratio in German banks is no less than 45 per cent., and at a very recent date the six leading German banks controlled a capital of £137,000,000, whilst the whole English banking system, excluding the Bank of England, holds a paid-up capital and reserve of £110,500,000.

It is held as a standard of British banking, as voiced by a late president of the Bankers' Institute, that "a banker should never be a partner," but exactly the opposite is the general rule in Germany. From the underwriting necessary at the flotation of a new company, or to increase the capital of an old one, the bank is predominant and retains its interest in the new or old concerns with which it is thus associated, much to the benefit of the enterprise. Georges Lachapelle states that in 1911 the Deutsche Bank was represented on 134 different boards, the Disconto on 114, and the Dresdner on 112. A statement by W. R. Lawson is of more value in this connexion than mine. He says "German banking does not stand aloof from industry—as ours does. The men who direct the German banks are at all times in close touch with the iron and coal industries, the manufacturing and trading classes, and the ocean steam lines. With them finance, industry, and transportation go hand in hand, and are regarded as integral parts of the same problem. The German banker has a finger in everything that is going on. He is represented directly or indirectly on the boards of manu-

facturing, trading, shipping and mining companies. He has his eye on all the staple markets. Underwriting is one of his recognised functions, and Germany is thereby spared many of the scandals of British company promoting. There are few commercial or industrial German ventures, be they private concerns or joint stock companies, which do not have at their disposal a fixed credit, uncovered, or covered by very unliquid securities, with one or more banks. Not only have the banks promoted most of the industrial joint stock companies and retained part of their share capital, but their managing directors remain members of the boards of these companies and draw personally large salaries for their services in this capacity."

German industrial enterprise owes a very great part of its success to this close association with the national banking interest, for the directors of these banks see to it that any appeal for public money with which they associate themselves shall be fully and satisfactorily reported upon by their large staff of industrial experts, and that their arrangements as to capital, management, and scientific assistance are approved by the highly-trained men on their boards. It leaves no question for doubt that such co-operation is a prime factor in the success of German industries in home and particularly foreign trade. An enterprise abroad, financed by a German bank, is compelled as a part of the financial agreement to place all orders for materials with German firms, and most generally firms in which the bank has a financial holding.

In the light of all this the system of extended credits which have been so prominent a feature of German foreign business need only be mentioned to be understood.

So far we have discussed conditions which affect many others besides the chemical industries, and we may now consider some which are more particularly attached to this special variety of industrial enterprise. We have already said that the demand for men having exceptional training in chemical and allied sciences has always been fully met by the German universities, and it is to be noted that the possession of a degree only is not accepted by the large firms as a warranty of fitness for a position on their staff, and in most cases a post-graduate course of two years which has been devoted almost wholly to research is insisted upon. The gateway to positions on the staff is through the research laboratory, and a further sifting out of the men takes place here before they are passed on to a post of departmental control in the works.

The remuneration of chemists in the research departments of the large works has not been on a lavish scale, for prior to the war the commencing salary was on the average 3,000 marks, rising to 5,000 marks at the end of four or five years. The first year of employment has always been recognised as a trial period, after which under satisfactory conditions a service agreement for a further four years is entered into. It has been the usual practice to reward a chemist for successful research which has been translated to the works by paying to him a percentage of the profits which have accrued to the firm as a result of this work, but this form of return has for some time been looked upon as unsatisfactory for a variety of reasons, but mainly on account of the difficulty of determining the fair proportion of the actual work done in bringing a discovery to fruition which is the result of the ability of any single individual. The tendency, therefore, has been to reduce these rewards to a very considerable extent, especially since in some cases the reward to the chemist has been out of all proportion to the actual work done. It has been recognised also that many brilliant pieces of work have gone without return to the chemist, merely because they have been unproductive, and in such cases a bonus has been voted to him, the amount of which is determined by the nature of the work carried out. The necessity for such a return is evident if the percentage principle is adopted, since a brilliant chemist would be penalised by having the most difficult problems set to him, whilst a man of lesser ability might be in the fortunate position of being set an easy task the solution of which brought him a high monetary reward.

The result of much inquiry concerning chemical engineers has led to the general statement that the men who can be designated by this description are the product of the works themselves. Certainly they are not accepted as such when they enter the works, although they may have taken courses at the universities specially designed to fit them for this particular branch of engineering work. The requirements as to their training are the same as those of the research chemist, but on entering the works they are attached to one of the engineers already on the staff, so that they may make a full study of the work they will be required to carry out. Usually a year or more elapses before they are given an independent piece of work to carry out for themselves, and one has only to see the results of their work to judge of the efficiency to which they attain. It is to be noted here also that it is always the chemist who holds the right of final decision as to the arrangement and construction of plant, the engineer being held responsible for the engineering work only, *i.e.*, in such matters as strength of materials, efficiency of power application, and the like.

An outstanding fact which is constantly being forced upon one's notice in these large works is the extraordinary way in which the purely chemical industry in its development has carried forward with it other industries concerned with the supply of the materials, whether for power, plant or process which it demands. This all-round advance of attached industries is in the greatest measure due to the utilisation of applied science and particularly chemistry in all branches of their work.

The preparation of metals having special resisting or other properties would be impossible without the chemist, and the beautiful earthenware and enamelled apparatus which is to be seen in general use has been produced largely with his assistance.

It would appear that the standardising of such apparatus as autoclaves, whether of plain metal or lined with enamel, of earthen pots, tubes and the like, greatly facilitates the work of plant erection, since it only requires a knowledge of the quantity of material to be handled in an operation to determine at once from a manufacturer's list what vessels and appliances have to be ordered, and usually they can be obtained from stock. Large stocks of such equipment as autoclaves, open and closed pans, with and without stirring gear, tiles for lining, tower packings and glass fittings are carried in the large factories, and it is an education in itself to walk through a storage yard in which such materials are contained.

There is no question that in this matter we have yet much to learn, and it may be hoped that with the increasing demand for such materials in this country we shall rapidly acquire the knowledge and technique which provide the German chemical manufacturer with such a wide range of excellent plant materials.

It was of course open to British manufacturers to obtain such supplies from Germany in pre-war times, and it cannot therefore be said that lack of them prevented the maintenance of organic chemical industry in this country, but that we were handicapped by the absence of such supplies at our own doors there can be no doubt, and we shall certainly be better able to meet competition when such a supply is forthcoming from British makers.

CHEMISTRY AFTER THE WAR*

SIR WILLIAM POPE.

One of the most important contributory factors to the late war was the striking contrast between the material resources of Germany and those of the rest of Europe, and in no domain was this more evident than in the chemical industry, which, more than any other branch of technology, is immediately concerned with the arts of war.

Before the war Germany supplied the bulk of the coal-tar colours consumed throughout the world, and so well organised and established was this industry that at the outbreak of war the mere rearrangement of the dye factories at once fitted them for the vast production of high explosives required to meet military demands. In this country facilities for the bulk production of high explosives were practically non-existent, and the state of our unpreparedness can be gauged from the facts that during the first year of war 80 per cent. of our output of TNT was derived from toluene contained in Borneo petroleum,† and we possessed neither the works nor chemists to produce the quantities of cordite required. About 97 per cent. of the world's production of quinine comes from the Dutch colony of Java, and its importation into Europe is practically under German control. The supplies of many essential drugs and anæsthetics, and also of dyes for making panchromatic plates, and of certain special steels were automatically cut off at the outbreak of war, and in this way Germany was able to throw her enemies into confusion by a purely economic method. The elaboration of methods for manufacturing nitric acid and its salts from atmospheric nitrogen was brought to a successful issue not long before the commencement of hostilities, and there can be little doubt that this circumstance was a factor in the declaration of war.

One essential difference is observable between the German practice and that initiated to fulfil corresponding war needs in this country. The German chemical factories were developed on a peace footing, and produced materials required by all countries; they were a source of great national wealth in time of peace, and were available for immediate conversion into explosives factories in time of war. The whole world, Britain included, paid for the erection and extension of these vast munition works. Now that war is over these factories can revert immediately to their former remunerative work of supplying the world with dyes, drugs, etc., and the great synthetic nitrogen works will now be able to supply Europe with a considerable portion of its demand for nitrogenous fertilisers. In this country explosives factories had to be hurriedly constructed for the war-time emergency without regard to their subsequent use for peace purposes. Thus the German chemical industry emerges from the war in a stronger position, whilst our own remains much as it was. Germany has not secured supremacy in fine chemical manufacture by the command of any monopoly of scientific talent; in fact a disproportionately large number of German technical products, and particularly of those used in gas warfare, was discovered by British scientists. Thus phosgene was discovered by John Davy in 1812, chloropicrin by James Stenhouse in 1848, and mustard gas by F. Guthrie in 1860.

The record of Great Britain in chemical discovery is one of which she may be proud, and many chemical industries well established in Germany may justly be said to be based on British discoveries. The coal tar industry and the fixation of nitrogen may be cited as examples, but none of the practical fruits has been gathered in Britain.

One of the truths established by the war is that this country commands a galaxy of scientific, inventive, and executive talent, for each military emergency has been met by rapid invention put into rapid practice by British technical effort. The lessons of the war must not be forgotten. It is essential to build up all branches of chemical industry, and for this a wide extension of scientific education and research is imperative. In one respect at least the British Empire is in a highly-favoured position: in one part or other it produces every raw material needed for its manufactures, although in the past it has left these sources of supply to be exploited largely by the foreigner. A great danger threatens us in the near future. A vast, silent mobilisation of all the resources of German scientific industry is in course of realisation for the purpose of nullifying the legitimate consequences of military defeat. It seems, too, that we are on the eve of a powerful propagandist movement to rehabilitate the German chemist in the eyes of the world.

* Communicated by Section B (Chemistry) of the British Association for the Advancement of Science. Abstract.

† The pre-war accumulation of TNT in Germany was mostly derived from the same source, and it was only some months after the outbreak of war that the Dutch shippers diverted the supply of Borneo petroleum to this country.—Ed.

THE CHEMICAL INDUSTRY CLUB.

Among the signs of the times is the increased measure of importance attached to the gregarious nature of man; the value of the social instincts, of human sympathy and of communal feelings in promoting industrial efficiency is, in particular, becoming recognised to an ever-increasing extent. It is therefore small wonder that this spirit has begun to penetrate and permeate the disconnected units which have hitherto comprised the profession of chemistry. It goes almost without saying that an enterprise aiming at social unity and professional solidarity among chemists must *ipso facto* appeal to them, and when such an enterprise has already successfully bridged the gap between aspiration and achievement the appeal must gain in momentum and ultimately bring all waverers into the fold.

The Chemical Industry Club, born amid the toil and tumult of war and homeless until a year ago, has now proved its worth as a social centre for those who think and practise chemistry and for some of those who traffic in its products; with a membership of 650 and a steadily increasing roll, it has established itself as a valuable addition to the general organisation of chemistry and chemical industry in this country, and as such demands the whole-hearted support of the profession.

The completion, on August 31 last, of the first year of its tenancy of the premises at Whitehall Court, S.W., was officially and appropriately marked by the holding of the annual meeting on October 20 and of the first annual dinner on October 31. The business at the annual meeting was purely formal; officers were re-elected, and on a ballot Mr. J. W. Black, Mr. A. G. Craig and Dr. W. R. Ormandy were added to the committee, which now consists of fifteen members.

The annual dinner was held in the Hall of the Tallow Chandlers' Company, Dowgate Hill, E.C., which was kindly lent by the Company for the occasion. Dr. Hodgkinson, the chairman of the Committee, presided, and there were present, besides a large gathering of members, the following guests: Mr. F. Cooper (Master of the Tallow Chandlers' Company), Sir William J. Pope, Mr. H. B. Ferguson (Technical Adviser to the Military Governor of

Cologne), Mr. John Gray, Dr. Rideal, Mr. Julian Baker, and Mr. R. B. Pilcher. Letters of apology for absence were received from Lord Moulton, Dr. C. C. Carpenter, Mr. R. G. Perry, Sir James Dobbie, Sir Herbert Jackson, and others.

Mr. H. B. Ferguson proposed the toast of the British Chemical Industry, and in doing so contrasted German chemical manufacturing organisation with British, pointing out the weak points in English methods and referring particularly to the need for improvement in the status of the chemist and the trust reposed in him. In replying to this toast, Mr. John Gray, who has been a member of the Club for some time, emphasised the need for such an organisation, and welcomed it very heartily.

Sir William Pope proposed the toast of the Chemical Industry Club. He spoke of the national scheme for amalgamating many of the activities of the different chemical societies, and of the provision of a club in connexion with that scheme. He pointed out, however, that so large a scheme must take time, and meanwhile he not only welcomed the present club, but commended the foresight and perseverance of those who had carried it to its present successful state.

Mr. H. E. Coley, hon. secretary of the Club, responded, and appealed to those leaders of British chemistry and chemical industry who have not already joined the Club to do so, because their moral support and advice were wanted, and because the Club was the only organisation of its kind which provided at a cheap rate club facilities for the younger chemists, who badly needed some such meeting centre. He repeated what has already been pointed out, that the Club is ready to associate itself with the national scheme when that is consummated.

Other toasts were those of the Worshipful Company of Tallow Chandlers, proposed by Mr. H. M. Ridge, and responded to by Mr. Cooper; and "The Guests," proposed by Mr. F. B. Davis, and responded to by Dr. Rideal and Mr. Julian Baker.

Many references were made in the speeches to the value of the Club and the work it is doing, and the whole proceedings were marked by a unanimity of feeling and enjoyment which promises well for its future.

NEWS FROM THE SECTIONS.

NOTTINGHAM.

At the opening meeting, held at the University on October 22, the chairman, Mr. F. H. Carr, read a paper describing his experiences as a member of the Commission sent by the War Office to investigate the "poison gas" factories of the occupied area in Germany. An abstract of this address will appear in an early issue.

BIRMINGHAM.

The first meeting of the session was held in the University Buildings on October 23, Dr. R. S. Morrell presiding in the unavoidable absence of the chairman. It was announced that Mr. L. P. Wilson had been elected chairman of the Section in the place of Dr. E. W. Smith, whose engagements made him unable to accept office, and that Dr. Morrell and Dr. Brownsdon had been elected vice-chairmen.

A paper by Mr. E. C. Rossiter and Mr. C. S. Dingley on "Some Chemical Aspects of the Potash Industry in Great Britain" was read by Mr. Rossiter, who gave the results of an inquiry, not yet complete, into the possible production of potash from the blast furnaces of England and Wales.

The chief source of the potash is the iron ore, containing from 0·526 to 0·153% K_2O (=0·833 to 0·242% KCl), the limestones and cokes not usually containing more than 0·1% KCl. The potash charged into the blast furnace comes out either in the slag combined with silicates, or in the gas as a very fine fume, which, after cooling, may contain the potassium as carbonate, bicarbonate, formate, cyanide, thiocyanate, sulphate, and chloride, with small quantities of bromides and iodides. It usually contains a very constant quantity of chloride with varying quantities of carbonate and a smaller quantity of cyanides, and it varies considerably for each works. In works where the gases are not cleaned, most of the potash carried in the gas eventually escapes up the chimney after the gas is burnt at the boilers and stoves. A small proportion is deposited with the heavy dust collected in the dust catcher and the first portion of the gas main, and a larger proportion (but less than 10 per cent.) in the stoves and boiler flues, where, after the gas has been burnt, it is present as a mixture of sulphate and chloride. The few figures collected indicate about 2 tons of heavy dust and 12 cwts. of boiler and stove dust per 100 tons of iron. The systematic collection of this dust would provide only a very minute proportion of our potash requirements, and owing to the low potash content of many samples it would be suitable only for local use in agriculture.

For the manufacture of potassium salts only that portion of the potash which is carried by the gas is available. The results obtained for 34 furnaces show that a comparatively small proportion of the potash is present in the gas under ordinary conditions of blast furnace practice. The greater the quantity of potash in the ores, the greater is the proportion remaining in the slag, and unless a large proportion of the potash remaining in the slag can be transferred to the gas the question of recovery is not worth considering.

This transference can be to a large extent effected by the simple addition of salt to the furnace charge. To test the view that the addition of salt had little effect in increasing the amount of potash in the gas, and that it merely converts the potash already present into chloride, two furnaces were run concurrently for a period of five days, one using 10 lb. salt per ton of iron and the other no salt. The results were: With salt, 11·5 lb. KCl in the gas per ton of iron; without salt, 1·96 lb.

From the results obtained the authors conclude that in furnaces using North Lincolnshire ores about 80 per cent. of the potash will be volatilised into the gas, and be recoverable by adequate gas cleaning plant; in hæmatite furnaces about 80 per cent, and in furnaces using Cleveland ores about 33 per cent. The best conditions for volatilising the potash are obtained in a highly basic charge subjected to a high furnace temperature, and the authors believe the retarded action of salt in furnaces using Cleveland ores to be due to the low ratio of lime and magnesia to silica in the slags.

On a conservative estimate the blast furnaces of England and Wales would be able to provide potassium salt equal to some 63,000 tons of KCl per annum, which might under favourable conditions be increased to 80,000 tons, representing an output approximately equal to double the pre-war consumption of this country.

NEWCASTLE.

At the initial meeting of the session held on October 27 at Armstrong College, Prof. P. P. Bedson presiding, an address was given by Prof. W. A. Bone on the Second Report of the British Association Fuel Economy Committee (this J., 1919, 355 R), which was followed by a discussion in which

Prof. H. Louis, Dr. J. T. Dunn, Mr. T. Hardie, and Dr. J. E. Paterson took part.

On the evening of October 30, about fifty members of the Section paid a visit to Messrs. Palmers' Iron and Steelworks at Jarrow-on-Tyne, and were subsequently entertained by the company.

EDINBURGH.

The first ordinary meeting was held at Edinburgh on October 28, Dr. D. S. Jerdan, the chairman, delivering an address on "Catalysis." After dealing with the original recognition of catalytic action by Berzelius, and the general characteristics common to reactions of this class, Dr. Jerdan described in greater detail the discovery of the organic catalysts or enzymes, and showed how they were eventually recognised by Moritz Traube to act in the same way as the inorganic catalysts The principal manufacturing processes in which enzymes are made use of were then discussed, special attention being paid to processes where the older empirical methods were giving place to methods based on the results of scientific investigation. The influence of enzymes in the tanning industry was referred to, and particularly the modern substitutes for the old puering process. The relation of enzymes to the butter-making and cheese-making processes was discussed with special reference to the various classes of enzymes at work in the preparation and ripening of cheese.

Recent developments in the application of enzymes or of the bacteria and moulds producing them were described, among them the preparation of acetone by the action of ferments on starch, and the treatment of distillery waste as devised by Effront and carried out at Nesle, in France, whereby large quantities of organic acids are recovered.

Lastly, the probable course of future developments in enzyme chemistry was briefly sketched, culminating in the possibility of the synthesis on the large scale of complex organic compounds by taking advantage of the reversibility of the catalytic processes induced by the enzymes, and in the synthesis of the enzymes themselves when their constitution has been fully investigated.

LONDON.

The first meeting of the session was held at the rooms of the Chemical Society, Burlington House, W., on November 3. After referring to the death of Mr. J. C. Umney, the chairman, Mr. Julian L. Baker, announced that Dr. C. A. Keane, the retiring chairman, had been elected vice-chairman. A vote of thanks was then passed to Drs. Keane and Miall for their excellent work in connexion with the organisation of the recent annual meeting of the Society.

The first paper, on "Black Lead Pencils and their Pigments in Writing," was contributed by Mr. C. A. Mitchell, whose work on writing inks and their analytical detection is well known. The first portion of the paper dealt with the historical aspect of the subject, a very numerous collection of early books at the British Museum and other libraries having been laid under contribution by the author, one of whose slides showed a picture of an English pencil dated 1565. The early manufacture of graphite pencils at Borrowdale was alluded to, followed by references to Faber's works in 1761, Conte's process of 1795, and so on to the modern composition pencils. Numerous tables showing analyses of specimens of graphite and pencil mixtures were shown, and some interesting differences (plainly discernible in the photo-micrographs) were clearly distinguishable, graphite markings in all cases showing highly characteristic striations which are entirely absent from the markings made with lead. The chemical methods employed in the identification of marks made by pencils, and the limits of sensitiveness obtainable in testing for the presence of iron, were then described. It is unfortunate that photo-micrography fails in many cases to distinguish with certainty which of two superimposed pencil marks was made first.

In the ensuing discussion, Prof. Hinchley emphasised the importance of fine grinding of the materials employed: for a high grade pencil, the mixture of clay, wax and graphite might be subjected to eight-days grinding, and even for a cheap variety one day is necessary. Dr. Ormandy referred to the preparation of very finely divided clay by the osmosis process for use in pencil manufacture.

The second paper was by Capt. E. T. Sterne on "Shawinigan Chemical Industries." A general description was given of the Shawinigan Falls, of the developed and available horse-power, and of the industries located near them. At the present time 320,000 h.p. is available, and this may shortly be increased to 625,000. The La Loutre dam forms a lake 400 sq. miles in area. The daily output from a single aluminium works is 60 tons, and one of the paper mills, employing 15,000 h.p., is turning out paper to 207 in. in width. Carbide is produced to the extent of 200 tons daily, and other industries include magnesium, carbon electrodes, aloxite, ferro-silicon and carborundum.

The production of acetic acid and acetone from calcium carbide was described at some length. Between 500,000 and 600,000 cu. ft. of acetylene are generated daily, and this gas is passed into dilute sulphuric acid containing suspended mercuric oxide in a vessel made of a special silicon iron. The mercuric oxide is made by oxidising mercury electrolytically and the residual mercury is recovered. The acetaldehyde so formed is oxidised to acetic acid by means of air in a vessel lined with aluminium; and the conversion of the acid into acetone is conducted in steel tubes which are filled with cast-iron balls coated with the catalyst (hydrated lime with a little magnesia) and maintained at 485° C. The walls of the tubes are also coated with the catalyst.

In 1900 Shawinigan was a forest wilderness; to-day it has 14,000 inhabitants, and in 1918 the products of its chemical industries were valued at 30 million dollars.

Dr. Keane and Mr. G. Patchin exhibited a metallic clip designed to prevent rubber connexions slipping off glass and metal tubing.

YORKSHIRE.

The session was opened on November 3 with an address by the chairman, Mr. W. Mackey, on "The Origin and Growth of Expert Evidence." This was followed by a paper on "The Change of the Refractive Indices of Fixed Oils with Temperature" by Mr. H. Wright. By combining Gladstone's equation connecting refractive index and density with Mendeleeff's equation connecting density and temperature, the author has obtained the formula:—

$$N = (N_1 - 1)\left\{\frac{1 - Kt}{1 - Kt_1}\right\} + 1$$

where N and N_1 are the refractive indices at temperatures $t°$ C. and $t_1°$ C., respectively, and where K is the modulus of expansion, which for fixed oils may be taken as 0·00076. When the refractive index of an oil has been determined at a given temperature, it is therefore possible to calculate its value for any other temperature. It was recommended that all results should be calculated to a standard temperature of 40° C. The author gave a number of examples, including olive oil, oleic acid and linseed oil, to show that the recorded values at different temperatures agreed with his formula.

MEETINGS OF OTHER SOCIETIES.

THE BRITISH COMMERCIAL GAS ASSOCIATION.

The eighth annual conference of this Association was held at Westminster on October 28 and 29. Lord Moulton, in his presidential address, paid tribute to the ready assistance afforded him when head of the Department of Explosives Supply by members of the gas industry. This industry has to get back to the stage of steady production before it can hope to attain the extensions so often discussed during the war. He suggested that effort might be concentrated upon work which did not involve increased capital outlay; and he advised caution with regard to the Government plan for the erection of electric superstations. The race between gas and electricity was about equal at present so far as the distribution of light and power was concerned. In regard to heat distribution, gas stood unrivalled. Gaseous fuel was the one defence against the monopoly of the oil companies in the matter of fuel for motor traction.

Sir Dugald Clerk delivered an address on "Coal Conservation as Aided by the Gas Industry." This subject necessitates the study of a large number of problems and the examination of coal in all its stages of production and use. The co-operation of mining, metallurgical, power and gas engineers was essential to a satisfactory solution. Remarking that the gas industry was responsible for dealing with, but not consuming, about 20 million tons of coal per annum, and that the total available water power in the United Kingdom amounted to 3 million horse-power available twelve hours per day, the speaker passed to a consideration of the relative efficiencies in use of gas and electricity for purposes of lighting, heating and power production on the lines of his recent paper to the Royal Society of Arts (this J., 1919, 104 R).

Sir Arthur Duckham remarked that with coal at twice the pre-war figure, fuel bills should not be much higher than in pre-war days, provided the fuel were efficiently employed. The appointment of electrical commissioners by the Government with a view to securing economy in coal, he regarded as a mistake. Much more necessary was the appointment of commissioners for heat, light and power, to investigate questions concerning gas production and the generation of electricity, the utilisation of coke-oven gas and the "waste" heat from blast furnaces, the development of water power, and allied subjects. It was desirable that gas distributed in the future should possess a uniform calorific value, uniform specific gravity, and be at a uniform pressure. He had recently seen results which showed that the most economical way of obtaining the high temperatures ruling in the electric furnace was by means of surface combustion.

Prof. J. W. Cobb also laid stress upon the desirability of viewing the question of coal conservation from the broad standpoint of light, heat and power production.

Papers were read by Dr. C. W. Saleeby on "The Smoke Nuisance in Relation to National Health" and by Dr. H. A. Des Voeux on "The Smoke Nuisance: A Plea for Action." In the latter paper it was stated that the coal thrown into the air of London in the form of soot amounted to 1000 tons per day. Dr. Leonard Hill dealt with "Scientific Heating in Relation to National Health," and Dr. S. Rideal contributed a paper on "The Hygiene of Gas and Electricity for Lighting." The latter's well-known investigations showed that, with natural ventilation, the proportion of carbon dioxide in the air of a living room was practically the same, whether the room were illuminated by gas or by electric light.

SOCIETY OF PUBLIC ANALYSTS.

The first ordinary meeting of the session 1919—1920 was held at Burlington House, W., on November 5, with Dr. S. Rideal, president, in the chair.

Mr. G. Rudd Thompson, in a paper on "Egyptian Bricks," described his investigations of some authentic specimens of sun-dried bricks some 3000 years old from the vicinity of Pithom, one of the fortified cities of the Captivity, with a view to throwing light upon the expression "Bricks without Straw"; the conclusion arrived at was that "straw" did not enter into their composition. The composition of the mud of the River Nile, as shown by these bricks, was remarkably similar to mud taken from the same source in 1912.

Mr. A. R. Powell and Dr. W. R. Schoeller gave a detailed description of "The Analysis of Brazilian Zirconium Ore." The finely ground material is fused with sodium carbonate, the melt extracted with water and the insoluble portion fused with bisulphate. This treatment eliminates silica and renders all the other constituents soluble. The solution is precipitated with sodium thiosulphate and the ignited precipitate weighed as $ZrO_2+TiO_2+Al_2O_3$. Titania and alumina are determined in this precipitate, zirconia being obtained by difference. Iron, manganese, lime, and magnesia are determined in the filtrate from the thiosulphate precipitate.

The last paper was by Miss E. M. Taylor on "The Halogen Absorption of Turpentine." In contradistinction to Wijs solution, a solution of iodine tribromide in chloroform was found to give a distinct resting stage at a halogen absorption equal to 4Br for $C_{10}H_{16}$. This stage was reached practically instantaneously by treating turpentine with a large excess of IBr_3, and titrating back at once; the secondary reactions leading to further absorption were sufficiently slow not to interfere with the much more rapid main reaction.

GAS STANDARDS AND THE SALE OF GAS.

Addressing a meeting of Press representatives at Whitehall on November 7, Sir George Beilby, chairman of the Fuel Research Board, referred to the necessity for revising the legislative conditions determining the sale of gas, and directed attention to the Report on Gas Standards by the Fuel Research Board (this J., 1919, 191 R). Conferences of producers and users of gas have been held under the auspices of the Board of Trade, and these have resulted in a number of resolutions being carried which are to be submitted to the Board of Trade for embodiment in the necessary Bill to authorise the sale of gas according to the new standards proposed. Among the decisions arrived at are the following:—

The proposed system of charging the consumer for the potential thermal units supplied is accepted. The unit to be adopted in charging the consumer is to be 100,000 B. Th. Units, and this will probably be called a "therm." The total units chargeable are to be calculated by multiplying the number of cubic feet registered by the consumer's meter by the declared calorific value of the gas per cubic foot. The calorific value is to be continuously measured and recorded by a standard type of recording calorimeter approved by the Metropolitan Gas Referees, who will also prescribe the method of installing, using and checking the same. The gas delivered is to be free from sulphuretted hydrogen, and during the period of two

years subsequent to the passing of the necessary Act is to contain not more than 20 per cent. of inert constituents, this maximum being reduced to 18 per cent. during the succeeding two years and to 15 per cent. thereafter. The producer is to declare the calorific value of the gas to be delivered and will undertake to adjust, and, if necessary, replace gratis consumers' burners, so that the gas may be utilised with safety and efficiency. A gas undertaking is at liberty to change its declared calorific value, due notice of such change being given to the consumer. The necessary adjustments, if any, of consumers' appliances are to be prepared during the period of such notice. Within a period of five years gas is to be supplied at such pressure that under normal conditions the pressure of the gas in any main or service pipe of at least two inches diameter is at least twenty tenths of an inch of water.

It will be seen that these resolutions are in general harmony with the original recommendations of the Fuel Research Board, although they differ from them in certain particulars, *e.g.*, the ultimate maximum permissible percentage of inert constituents is to be 15 and not 12 per cent. The original recommendation concerning pressure specified one of not less than two inches of water at the outlet of the consumer's meter. The present recommendations supplement and to some extent modify the original recommendations concerning the determination of calorific value and the readjustment of consumer's appliances.

PERSONALIA.

Dr. E. K. Rideal has been awarded the degree of D.Sc. in chemistry by the Senate of London University.

Mr. A. E. Duncan has been appointed Controller of Coal Mines in succession to Sir Evan Jones, who recently resigned.

The British Cotton Industry Research Association has appointed Prof. A. W. Crossley, of King's College, London, to be Director of Research.

Mr. F. G. Edmed, of the Directorate of Chemical Inspection, Royal Arsenal, Woolwich, has accepted the appointment of Superintending Chemist, Admiralty Inspection Department, Holton Heath, Dorset.

Sir Richard Redmayne has relinkquished the temporary position which he accepted in 1917 as Director of Production and Technical Adviser to the Controller of Coal Mines and has resumed his permanent duties as Chief Inspector of Mines at the Home Office.

LEGAL INTELLIGENCE.

Customs Seizure of Pyrogallic Acid. *Brown and Forth* v. *Buckley*. (See this J., 1919, 379 R, 399 R.)

On October 29, Mr. Justice Sargant, in the Chancery Division, heard a motion by the Attorney-General on behalf of the Crown to stay this action, After discussion it was agreed that an early day should be fixed for the trial, subject to the convenience of the Attorney-General.

In the King's Bench Division on November, before Mr. Justice Sankey, the date of the trial was fixed for November 18.

NEWS AND NOTES.

FRANCE.

Conference of Leather Chemists in Paris.—In the current number of *Chimie et Industrie* M. Jean Gérard describes the meeting of leather chemists which was held in Paris on September 22 and 23. The International Association of Leather Trade Chemists was founded in London in 1897, and by 1914 had a membership of over 500, recruited from nine different countries; in 1917 it was re-constituted under the title of The Society of Leather Chemists, and membership was then restricted to representatives of Allied and neutral countries. The rules of the Society have now been brought into harmony with those of the International Union of Pure and Applied Chemistry.

The presidential address of Prof. Meunier dealt with the more important advances made in the chemistry of leather since the last congress held in London in 1912. The work of Procter and Wilson, of Abt, Jocum, Becker, Seymour-Jones, Tilley, Schlichte, Wood, Sand, Law, Moeller and Hough was briefly reviewed.

The communications presented were restricted to the discussion of urgent questions relating to official methods of analysis. Measures were adopted with a view to establishing the exclusive use of the shake method for commercial estimation of tannins. The committee appointed to investigate the official hide powder was asked to act rigorously, and it was decided to notify in the Society's Journal each time a new delivery of powder had been tested and approved for use. The committee of the English section dealing with the analysis of leather was enlarged to include French and Italian members, and invited to co-operate with the American association with a view to devising an exact official method. This committee is also to draw up a detailed plan with regard to the drawing of samples from bulk. The official method of analysis for sulphonated oils, provisionally adopted by the English section, was approved. Prof. Baldracco (Italy) contributed a paper on the analysis and detection of mixed tanning materials.

Dr. J. Gordon Parker was elected president for 1920–21, and it was decided to hold the next conference in London in 1921.

The Use of Substitutes in the Construction of Chemical Plant.—It seems very probable that France will adopt for good the war-time practice of using substitutes for copper, zinc, tin, nickel, bronze, and lead in the construction of chemical plant and apparatus. These substitutes consisted in the main of thin layers of metal resting on an iron or concrete base. Thus acid-resisting foundry pig iron, sandstone, glass, etc., have been of the greatest utility, and pans of concrete lined with glassy or refractory material have proved efficient substitutes for copper pans. Reversion to the use of copper, nickel and tin would but swell the volume of imports, depreciate the exchange still further, and involve sacrificing the successful results of the application of much skilled labour. It would appear that the use of copper for chemical plant has been more a matter of routine or habit than of necessity.

AUSTRALIA.

The Tinfields of New South Wales.—The New South Wales Government geologist has recently visited the Ardlethan tinfield and inspected the principal mines. He expressed himself as impressed with the potential wealth of the field, which he regards as a valuable national asset. There is much payable ore which is lost or overlooked by the present method of working the richer shoots.—(*U.S. Com. Rep., Sept.* 12, 1919.)

Projected Steel Works in Queensland.—Experts have been examining the various ore fields in Australia and New Caledonia in connexion with the establishment of State iron and steel works in Queensland, and have reported most favourably on the prospects of shipping ore from New Caledonia to a North Queensland port. The ore deposits of this island are located in the south, where huge quantities occur adjacent to excellent harbours. The quality of the ore is stated to be rich and the mining conditions favourable.—(*Industrial Australian, Sept.* 4, 1919.)

UNITED STATES.

Presence of Zinc in Foodstuffs.—Recent work upon the ash of various foods discloses the presence of zinc in quantities up to 415 mg. per 1000 grms. of fresh material. Bakers' yeast, wheat, oats, corn, barley, rye, rice, milk, and eggs were all found to contain zinc. Inasmuch as this metal constantly occurs in the yolk of eggs, in human, and in cow's milk, it is possible that it plays an important part in animal and vegetable metabolism.

The Forest Products Laboratory.—This research laboratory has now a peace-time staff of about 200 men, and much of the work begun on war problems is being continued with reference to normal requirements. Thus, investigations relating to aeroplane construction are found to be valuable to the furniture and veneer manufacturers. Important work is being undertaken on the use of hard-wood oils and tar for ore flotation, for which pine products have hitherto almost exclusively been employed. In this work the Bureau of Mines is co-operating by conducting the flotation experiments with the materials furnished by the Forest Products Laboratory. The production of high-grade paper from cotton linters of the munition class is also being investigated.

JAPAN.

Japanese Chemical Works.—The following statistics give, A. the numbers of various chemical works in operation in Japan at the end of 1917, and B. the numbers of workers engaged therein:—

CANADA.

Mineral Production of British Columbia in 1918.—The annual report of the Minister of Mines states that the gross value of the mineral production for 1918 exceeds that in 1917 by 12·9 per cent., but the increased value of metallic minerals alone is only 2·3 per cent. The quantity and value of the principal mineral products obtained during 1917 and 1918 is shown in the following table:—

	1917.		1918.	
	Quantity.	Value. $	Quantity.	Value. $
Gold placer (oz.)	24,800	496,000	16,000	320,000
,, lode (oz.)	114,523	2,367,190	164,674	3,403,812
Silver (oz.) ..	2,929,216	2,265,749	3,498,172	3,215,870
Lead (long tons)	16,655	2,951,020	19,598	2,928,107
Copper ,,	26,342	16,038,256	27,448	15,143,449
Zinc ,,	18,682	3,166,259	18,648	2,899,040
Coal ,,	2,149,975	7,524,913	2,302,245	11,511,225
Coke ,,	159,905	959,430	188,967	1,322,769
Miscellaneous products ..	—	1,241,575	—	1,038,202
Total value		37,010,392		41,782,474

The armistice caused a heavy drop in the demand, and consequently in the value of lead, copper and zinc. In many cases the producers hold large stocks of ore, but the sales are few.

The zinc ore was raised almost entirely in the Fort Steele and Slocan districts, the output from the first-mentioned being treated at the Trail electrolytic refinery. The chief producers of lead ore were the Fort Steele, Slocan and Ainsworth districts.

The largest production of copper, as in former years, came from the Skeena Division, followed by the Southern Cross and Boundary-Yale districts.

The output of coal was hampered by the shortage of labour. The bulk of the output was obtained by three companies, viz., the Crow's Nest Pass Co. of East Kootenay, the Canadian Collieries and the Western Fuel Co. of Vancouver Island, which produced 23·6, 30·7 and 28·4 per cent., respectively, of the total.

Small quantities of chromite, magnetite, manganese ore, molybdenite, arsenic, fluorspar and platinum were also obtained in 1918.

	A. Works.			B. Employees.					
				Over 15.		Under 15.		Total.	
Industry.	Using power.	Not using power.	Total.	Men.	Women.	Boys.	Girls.	Male.	Female.
Dyeing	203	165	428	9,349	2,925	313	264	9,662	3,189
Ceramics	493	579	1,072	41,221	8,703	3,731	566	44,955	9,269
Paper-making	226	97	323	12,742	7,196	922	1,191	13,664	8,387
Lacquer	2	25	27	464	115	41	11	505	126
Leather tanning and fur-finishing	22	10	32	685	21	24	—	709	21
Explosives and Matches	94	95	189	5,491	11,939	1,080	2,972	6,571	14,911
Oils and Wax	97	14	111	4,434	726	14	131	4,448	857
Chemicals	260	13	273	12,755	2,402	71	158	12,826	2,560
Rubber	75	13	88	3,673	2,126	108	163	3,781	2,289
Toilet Goods	10	14	24	330	851	3	176	333	1,027
Soap and Candles	49	9	58	1,293	810	76	155	1,369	965
Dyes, Paints, and Pigments	54	22	76	2,511	411	19	25	2,530	436
Fertilisers	36	6	42	1,789	175	2	—	1,791	175
Fermentation	564	771	1,335	28,846	946	161	12	29,007	958
Sugar	24	3	27	1,994	193	28	31	2,022	224
Mineral waters	71	1	72	1,047	675	28	32	1,075	707
Gas Works	35	2	37	1,571	35	3	—	1,574	35
Miscellaneous Chemical works	130	61	191	5,249	1,800	163	52	5,412	1,852
Total	2,505	1,900	4,405	135,444	42,049	6,790	5,939	142,234	47,988

Wages.—Recent labour propaganda against capitalists has been followed by a very great increase in wages. The following table gives the daily wage rates in some of the chemical industries at the end of 1917. The present rates are on the average about 50 per cent. higher:—

	Male	Female (over 15)		Male	Female (over 15.)
Ceramics	Yen 0·75	0·36	Paper	Yen 0·85	0·35
Glass	0·75	—	Explosives	1·00	0·36
Leather, fur	0·78	—	Perfumery	—	0·38
Fatty oils	0·77	—	Wines, spirits	0·75	0·38
Textile, finishing	0·73	0.35-0.36	Fertilisers	0·75	—
Dyeing	0·86	—	Cement	0·80	—
Camphor	1·00	0·36			

Meeting of the Industrial Commission.—The Canadian Government held a joint gathering of representatives of capital and labour during the week September 15—22, which was attended for the first time by representatives of technical and professional men, who formed a third or neutral party. The Society of Chemical Industry in Canada was represented by Mr. Crossley, of Toronto. The opinions of professional and technical men in Canada have never been called for by the Government, labour or capital, and it is felt that the time has come when this so-called "neutral" group might be consulted with advantage to all parties.

A New Use for Flotation Machinery.—The Groch Centrifugal Flotation Co., of Cobalt, Ont., has perfected a flotation machine for floating paper stock. The paper mills lose about 7 per cent. of total stock, and while screens can save 50 per cent. of this, the new system would float off 90 per cent. at a cost of less than 20 h.p. per 1000 galls. per minute. It would be profitable to run this machine on back waters carrying as low as 3 cents per ton of water.

Canadian Universities.—With the opening of Canadian universities in October, a very marked increase in attendance is shown, beyond the highest records previous to the war. Science courses are particularly crowded and over 1200 returned soldiers are in attendance at the University of Toronto, a slightly lower number at McGill, Montreal, and somewhat fewer at Queen's, Kingston, Ontario. An era of very rapid expansion is now being entered upon by all educational organisations in the Dominion. The University of Toronto, and the Province of Ontario have promised to support the efforts of the Textile Institute to obtain courses of advanced technical education suitable to the needs of this industry.

GENERAL.

The Harrison Memorial Lecture.—This memorial lecture, which was delivered by Mr. Francis H. Carr before the British Pharmaceutical Conference in July last and of which a reprint from the *Pharmaceutical Journal* has recently been issued, contains the most complete account of the life, character and work of the late Colonel E. F. Harrison (*cf.* this J., 1918, 446 R) which has been published, and it makes us realise more than previously the great loss which chemistry and the country suffered by his untimely and self-sacrificing death. The second part of the lecture contains a detailed description of the preventive measures taken to cope with the lethal gases employed by the enemy. We learn that the total output of the second and more perfect type of box respirator was no less than 20,000,000. The chief absorbents employed were lime, caustic soda, permanganate and wood charcoal, and as much as 300 tons of wood had to be carbonised weekly to supply the demand for the last-named material. After the respirators had been carefully assembled, they were subjected to rigorous tests in an atmosphere containing a determined proportion of the offensive gas—this proportion being raised from its initial value of 1 in 10,000 in 1915 to 1 in 100 in 1917. In all this work, and in much else, *e.g.*, the detection and estimation of minute traces of the various gases, Harrison was responsible in a supreme degree for the co-ordination of pure scientific work, technical effort and manufacture.

The Position in Germany.—Mr. Irving A. Keene, chairman of the committee on drugs, chemicals and dyestuffs of the American Chamber of Commerce in London, has quite recently returned from a tour of inspection of chemical works in the occupied and unoccupied areas of Germany. His report confirms information received from other sources, namely, that owing to the dearth of coal, raw materials and credit, no competition worthy of the name is to be feared from Germany for at least a year. The big firms producing dyes and drugs are working for private German account, and after the demands of the Allies under the Peace Treaty have been met, *viz.*, delivery of 50 per cent. of stocks as at January 1, 1919, there will be practically nothing left for foreign sale. Added to this there is the further condition of surrender to the Allies of 25 per cent. of the annual output until 1925. The reduced productivity of the workpeople, estimates of which vary from 33 to 75 per cent. of the pre-war normal, is largely the result of socialistic agitation, which, Mr. Keene thinks, is unlikely to last, for the German workman will realise before long that social equality, as expressed by idleness, does not put food into his mouth. Apart from the working classes, the German population is as industrious as ever. Although great trouble may ensue during the coming winter through lack of coal, Mr. Keene anticipates that the recent excellent harvest will keep the country on its feet.

Conditions that Govern Staleness in Bread.—In a pamphlet bearing this title Captain R. Whymper describes investigations carried out in the British Army bakeries in France during 1917-18. The results are given under four headings: I. Determination and location of losses occurring in the manufacture of bread; II. Conditions that govern staleness in bread; II. Changes occurring in bread with age; IV. The colloid nature of starch pastes, bread crumbs, etc. It was found that the cooling of bread takes place in three stages, namely, the steam period, during which most of the drying-out takes place in a given time; the condensation period, during which the rate of drying is only one-fifth that of the steam period; and the drying period, in which the rate of drying is about one-fourth that of the steam period. Loss of moisture from the centre of the loaf is inconsiderable until after 100 hours under ordinary conditions, an actual increase being often observed before this time. The zone of drying-out is very narrow in a loaf up to about 100 hours, being about 1 in. inwards from the crust; after 100 hours the moisture diffuses gradually from the centre of the loaf, but at so slow a rate that there is always a pronounced difference between the moisture content of the crumb at the centre of the loaf and that of the crumb beneath the crust. The loss of water during cooling and drying-out is not responsible for staleness. During the process of becoming stale the soluble extract of the crumb decreases, this decrease being followed after a time by an increase. The quantity of soluble starch in bread crumb diminishes rapidly between the sixth and twenty-fourth hours of the cooling period; a similar fall and rise of soluble extract is observed in starch pastes. Staleness may be attributed to deposition of solid starch in the crumb caused by change of temperature during the cooling period and accelerated by the presence of solid starch particles already existing in the crumb. Staleness is also due to polymerisation of starch, which tends to crumble the gelatinous nature of the bread crumb when fresh. Other changes occurring in the proteins of bread crumb may be responsible for staleness, but these have not yet been investigated.

Artificial Honey in Germany.—Artificial honey was consumed in Germany in large quantities during the war. Although the conversion of cane sugar into invert sugar is a simple chemical process, the products of different firms were lacking in uniformity, a considerable portion consisting of a thin fluid. For the production of a thick variety the water content and the inversion of the cane sugar are matters of great importance. The water content must not exceed 22 per cent. and the inversion must be complete to within 5 per cent. The inversion proceeds best when at least 0·1 per cent. of formic acid is present. The strongly acid taste of the product is removed by neutralising with sodium carbonate. The enactment of a law similar to that concerning margarine is recommended in order to prevent confusion between natural and artificial honey in the trade. On economic grounds, thick artificial honey is an indispensable product in Germany.—(*Schweiz. Chem.-Zeit.*, 1919.)

The Aluminium Industry in Germany.—Aluminium has become, in a short time, a factor of considerable importance in the metal market. The many applications of aluminium during the war will remain and be considerably extended in peace time. Before 1914 Germany possessed only one factory for the production of aluminium, in the region of the Rhine (Baden), a factory affiliated to the important Swiss Neuhausene Aluminiumindustrie A.-G., in which company both French and German capital is invested. The output of this factory was only 800 tons annually, and the twenty times greater requirements of German industry had to be supplied by metal imported from Switzerland, France and England. German capital was not forthcoming for the erection of large new works; and, moreover, the price of aluminium prior to the war—M. 1·50 to M. 1·80 per kilo.—was not altogether attractive for this purpose. The shortage of metals, occasioned by the blockade, assisted in the establishment of a German aluminium industry, although this was not achieved without difficulty. With the failure of supplies of bauxite and alumina from Switzerland, Germany was finally thrown upon her own resources. The erection of aluminium factories was decided upon in 1915, and they were completed in an unparalleled short time. The largest works is the Erftwerk, A.-G., at Grevenbroich, on the left bank of the Rhine. In place of copper, aluminium was principally employed in shipbuilding and in the electrical industry. On account of its lightness and the tenacity of its alloys it found considerable application in aeroplane and airship construction. The wide application of aluminium is exemplified by the fact that in America parts of railway and street wagons are customarily built of aluminium, *e.g.*, the sides, tops and doors thereof, while it displaces brass in the construction of armatures. Its field of usefulness extends to the construction of automobiles, agricultural and industrial vehicles, to the chemical and brewing industries, to bell casting, and it is anticipated that for purposes of electric transmission aluminium will enter into keen competition with copper. On account of its low specific gravity, 1 kilo. of aluminium is equivalent to 2·5 kilo. of copper, so that aluminium can be used with advantage in place of copper even when its cost is 2½ times greater. In the electrical industry, owing to the lower conductivity of aluminium, the advantage gained by its use is not so preponderating, but even here 1 kilo. of aluminium is equivalent to 2 kilo. of copper. These facts demand attention on political and economic grounds. Dependent on other countries for copper, nickel, tin, etc., Germany is self-sufficing as regards aluminium. Much capital would remain in the country were the import of copper reduced. The price of aluminium about the year 1905 was from M. 3·25 to M. 3·75 per kilo., and this fell to M. 1·05 to M. 1·25 in 1911, and then increased again to M. 1·80 before the war, and its price has now increased six-fold, and will probably rise still further. Information concerning the price of aluminium in foreign countries is discordant, but it is certain that owing to currency exchange conditions foreign aluminium is to-day considerably dearer than the German product. One fact is of extreme importance: the use of every kilo. of German aluminium reduces the import of copper by from 2—3 kilo.—(*Z. angew. Chem., July* 18, 1919.)

The Mining Industry of Indo-China.—*La Dépêche Coloniale* gives the number of mining concessions granted in Indo-China up to January 1, 1919, as follows:—Coal 63, zinc and lead 91, lead and silver 3, tin and tungsten 30, gold 12, copper 9, iron 3, antimony 4, and mercury 3. Total, 218.

The coal production over the period 1914 to 1918 (inclusive) has remained fairly constant at 650,000 tons per annum, but the exports have fallen from 400,000 tons in 1915 to 252,000 in 1918.

The tin and tungsten mines have shown a steady increase in production from 309 tons in 1914 to 604 tons in 1918. Of the 1918 output, 218 tons consisted of high grade (70%) wolfram and 119 tons of high grade (60%) tin ore, the remaining 263 tons being mixed tin and tungsten ores. Prices have been high during 1918, tin averaging 9000 francs per ton and wolfram 100 to 120 francs per unit of tungstic acid. Unfortunately, want of shipping has only allowed of the disposal of half the production at these favourable rates.

The zinc industry has been seriously hit during the last two years by the loss of the Japanese markets to the Australian producers. The quantities of Tonkin tin ore extracted during the war have been:—1914, 31,000 tons; 1915, 36,000 tons; 1916, 48,000 tons; 1917, 39,000 tons; 1918, 28,000 tons. Total, 182,000 tons. Of this quantity only 130,000 tons has been exported; 57 per cent. to Japan, 34 per cent. to Europe, and 9 per cent. to the United States.

There are extensive deposits of iron ore in Indo-China, but they have not been developed. During the last year, however, several hundred tons have been extracted and smelted at Haipong, where the newly erected furnace produces about 15 tons of iron per day.—(*Bd. of Trade J., Sept.* 18, 1919.)

Salt, Bromine, and Calcium Chloride in 1918.—*Salt.*—The total salt production in the United States was 7,238,744 short tons in 1918, being 3·7 per cent. more than in 1917. The average price was \$3·72 per ton, compared with \$2·86 in 1917; rock salt was cheaper than evaporated or brine salt, and the price of each varied according to locality. The production costs tended to increase in greater proportion than the selling price, but showed wide variations. Of rock salt 1,683,941 tons was mined, chiefly in New York and Kansas; there is only a demand for small quantities in the Western States, where large deposits exist near the surface.

Various grades of salt are produced by evaporating natural and artificial brine; there is an increasing demand for pressed blocks for salting cattle, the 1918 output of this grade being 94,150 tons (chiefly in Kansas). Chemical companies converted nearly 3,000,000 tons of brine salt into various sodium salts and into calcium chloride, chlorine and hydrochloric acid. Michigan, New York, Ohio, Kansas, and California were the most important districts for brine evaporation.

Most of the salt (7,142,251 tons) was produced for domestic consumption. Imported salt, mainly coarse solar salt from the West Indies and Spain, decreased from 130,804 tons in 1914 to 40,290 tons in 1918. About 17,000 tons of English salt was imported to supply packers. Over 136,000 short tons of salt was exported in 1918, or 20 per cent. more than in 1917. The largest consumers were Canada, Cuba, New Zealand, Mexico, and Panama; South American countries were more largely supplied from England.

The production of salt in Canada (Ontario) amounted to 131,727 tons in 1918. A deposit of rock salt is being developed in Cumberland County, Nova Scotia. Practically all the salt produced in the West Indies, Mexico, and Central America is solar salt; there are salt mines in Guatemala. Rock salt is mined in Chile and Columbia, and sea water is evaporated in Argentina, Brazil, Venezuela, and other South American countries.

In Europe, England produces 2,000,000 tons; Germany 2,000,000 tons, and Austria Hungary 800,000 tons. France, Spain, Greece, Turkey, and Italy evaporate sea water. There are mines in France, Rumania, and Switzerland. Russia produces 2,200,000 tons from salt lakes, rock salt, and by the evaporation of brine. In Spain there are large deposits of rock salt as yet untouched.

China produces 1,800,000 tons of salt under Government monopoly. India imports 150,000 tons of solar salt from Aden and produces over 1,000,000 tons from rock salt deposits in the Punjab, from the Sambhar Lake in Rajputana, from the lesser Rann of Cutch, and from sea-salt factories in Bombay, Madras, and at the mouth of the Indus. Japan and Siam derive their supplies from solar evaporation.

Sea water is evaporated in northern Africa, and South African supplies are derived from salt springs. Salt is imported into other African countries.

Australia draws her supplies from South Australia and Victoria and from England; New Zealand imports from England and the United States.

Bromine.—The bromine production in the United States was 1,727,156 lb. in 1918, an increase of 92·9 per cent. compared with 1917. It was made as usual from the brine pumped in Michigan, Ohio, and West Virginia, and large quantities were exported to Europe as bromine or bromides for use in medicine, photography, and asphyxiating gases. The wholesale price was 25·35 cents per lb. in 1913, it rose to $5·00—$6·50 in 1916, but was fairly steady at 75 cents in 1918 prior to the armistice.

Calcium Chloride.—Large quantities of calcium chloride are produced as a waste product of the ammonia soda process in New York, Michigan, Ohio, Kansas, and Virginia. In addition, 26,624 tons of calcium chloride containing 2—6 per cent. of magnesium was recovered from natural brine in 1918, the average price being $18·90 per ton (*U.S. Geol. Surv., Aug.*, 1919.)

The Uses of Magnesite.—In addition to the primary use of magnesite for refractory purposes, it is also employed in the manufacture of magnesium oxychloride or Sorel cement, the value of which is based on the fact that a finely ground calcined magnesite when wetted with a solution of magnesium chloride of a certain strength solidifies or sets to an exceedingly strong and hard mass. The oxychloride so formed is generally modified by the addition of various filling materials, such as wood flour, cork, talc, silica, asbestos, clay, marble dust, and sand, besides colouring matter. The cement is sold under several trade names, and is commonly referred to as sanitary flooring. When well-laid, magnesite cement has some decided advantages over other cements for use as flooring. It produces a smooth, even floor, which may be laid in large areas without cracking. It takes colour well, and is susceptible to good polish by oiling and waxing. It is laid in a plastic state on wood, steel or concrete. Its surface seems to have a resilience not given by ordinary cement, and it does not pulverise. The use of magnesite cement on floors and as stucco or wall plaster is gaining in importance in the United States; and it was reported that magnesia cement was used by the Germans for gun emplacements, because it sets quickly and attains great strength much sooner than Portland cement.

Californian magnesite has been used for many years in the manufacture of wood-pulp paper on the Pacific coast. Magnesium bisulphite is said to have more solvent action on the free resins of the wood than lime, and it also has an additional advantage in that the residues left in the paper stock are not afterwards injurious to sizing agents. In the sulphite process of paper manufacture magnesium bisulphite is found to be more stable than calcium bisulphite, and it dissolves the noncellulose matter more completely. Sodium bisulphite gives a better product than either of the two mentioned, and strong liquors can be made from it, but it is too expensive for general use. (*U.S. Geol. Survey, July*, 1918.)

Production of Candelilla Wax in Mexico.—The candelilla shrub, of an average height of 25in., grows abundantly and in a wild state in Mexico, more particularly in the Monterey district, where there are several factories for extracting the wax. At the present time (end August, 1919), owing to the low price of the wax, there is only one large factory operating, with a daily output of 662 lb., but it is reported that another large one will be opening shortly. The wax is extracted by putting the shrubs, as gathered, into water, which is then heated to the boiling point. Sulphuric acid is then added, and the separated wax is collected and put in receptacles until it solidifies. It is then treated with steam in another tank, sulphuric acid being again added. Thus refined the wax is cast in moulds and is then ready for shipment.—(*U.S. Com. Rep., Sept.* 12, 1919.)

PARLIAMENTARY NEWS.

HOUSE OF COMMONS.

Price of Coal.

On the motion for the adjournment, and in reply to Mr. Holmes, who contended that the increase of 6*s.* per ton in the price of coal was no longer justified, Sir A. Geddes said that the only new fact in the situation was that the output of coal for the last quarter was at a lower rate than the estimate. There was also a loss of £22,000,000 on the control arrangements, and this was being borne by the Treasury. Referring to the very large profits which some of the collieries were making, he said that when these profits were reduced to 1*s.* 2*d.* per ton (under the Sankey Report), and when the surplus provided by these collieries was taken to make up the deficiency at other collieries, the apparently great profits would largely disappear. The Board of Trade was most anxious that the price of coal, and especially that of bunker coal, should be lowered, but the best economic opinion was entirely adverse to effecting this by way of granting a subsidy.—(Oct. 27.)

Coal Consumption in Coke Ovens.

Answering Mr. Atkey, Mr. Bridgeman, for the Board of Trade, stated that the quantity of coal carbonised in bee-hive and patent coke ovens in the United Kingdom was approximately 20 million tons in each of the years 1917 and 1918.—(Oct. 28.)

Vegetable Oil-seed Products.

The Under-Secretary of State for the Colonies informed Col. Wedgwood that ordinances have been passed in four West African Colonies imposing, as from October 20, a duty of £2 a ton upon palm kernels when exported to destinations outside the British Empire. This duty does not apply to other kinds of oil-seeds; and (in reply to Mr. Hayday) the object of this duty is to prevent trade in palm kernels reverting to Germany.

In order to secure an adequate supply of oil-seeds and their products, including margarine, for the next few months, the Governments have been requested to prohibit the export of palm kernels, groundnuts and copra to destinations outside the Empire. Licences will be granted for the exportation to lawful destinations of the following proportions of the quantity shipped to the United Kingdom:—Palm kernels, one-ninth; groundnuts, one-fifth; copra, an equal quantity.

Mr. Montagu stated, in reply to Col. Wedgwood, that the Government of India considers it unnecessary to regulate the export of copra and coconut oil from India on the lines of the scheme above mentioned.—(Oct. 29.)

Coal Production.

In response to information asked for by Mr. Hartshorn, Sir A. Geddes issued statistics giving the average number of persons employed in coal production, and the total output for each of the four quarters ended September 30 last; also for four-weekly periods from June to September, together with average output per man per week and per man per shift, percentage of absenteeism, etc. For the quarter ended December 31, 1918, the profit (including interest) was 3s. 4d. per ton raised.—(Oct. 29.)

Flax Production.

Sir A. Boscawen, in a written reply to Mr. Stewart, explained the objects of the Flax Production Scheme of the Board of Agriculture. The capital expenditure on land, buildings and equipment is £750,000; other expenditure, including the training of workers and experiments, £850,000; estimated further expenditure on 1918 and 1919 crops, £9,000,000; revenue to date, £300,000; and estimated further revenue from stocks in hand, £1,300,000. The Board is now considering offers for the purchase of the whole undertaking, and it is confident that with efficient management the industry has every prospect of success.—(Oct. 29.)

Spitzbergen.

The Under-Secretary of State for Foreign Affairs intimated to Sir Martin Conway that the Supreme Council in Paris has conferred the sovereignty of Spitzbergen on Norway. The conditions attached to the treaty will adequately safeguard existing British rights. The territory claimed by British companies is, approximately, 4000 sq. miles, by Norwegian 900 sq. miles, by Swedish 350 sq. miles, and by Russian 100 sq. miles.—(Oct. 30.)

Quinine.

Mr. Bridgeman confirmed Mr. Spoor's statement that the world's production of quinine, apart from a little produced by the Government of India for local use, has lately been made the subject of a monopoly by the Dutch and British producers. The whole question of the prices and supply of quinine sulphate is being investigated under Section 3 of the Profiteering Act.—(Oct. 30.)

Dyes.

Major M'Kenzie Wood asked the President of the Board of Trade if the subsidised dye manufacturers are supplying to woollen manufacturers dyes which are not fast to milling, and if, in consequence, large quantities of good material are being spoiled weekly.

Sir A. Geddes replied that he had received no information or inquiries on this specific question. —(Nov. 3.)

Quality of Gas Supply.

Sir A. Geddes, replying to Mr. Gilbert, who had drawn his attention to the poor quality of gas supplied by certain gas undertakings in the London area, announced that he would shortly introduce a Bill giving effect to the recommendations in the recent Report of the Fuel Research Board, whereby gas will be charged for on the basis of its calorific power.—(Nov. 3.)

Derbyshire Oil.

In reply to Sir A. Fell, Mr. Kellaway stated that progress in boring had been recently somewhat retarded by unavoidable accidents and difficulties in getting material. Oil was still flowing from the Hardstoft boring at the rate of about 260 galls. a day, and there was about 36,500 galls. in stock.—(Nov. 11.)

REPORTS.

Mines and Quarries: General Report, with Statistics, 1918. *By the* Chief Inspector of Mines. *Pt. I., Divisional Statistics and Reports.* [*Cmd.* 339. 9d.] (*London: H. M. Stationery Office.*)

During 1918 there were 7637 mines and quarries at work, and the number of workers was 1,072,903, showing net decreases of 410 and 12,568 respectively over the previous year. There were 1,487 deaths from accidents, an increase of 48. The total output of minerals is shown in the following table:—

Summary of Output of Minerals from Mines, Quarries and Brine Wells.

Minerals.	Total output, 1918.	Total, 1917.
	Tons.	Tons.
Alum shale	5,231	5,555
Antimony ore	1	—
Arsenic	2,349	2,626
Arsenical pyrites	477	434
Barium (compounds)	66,360	65,557
Bauxite	9,589	14,724
Bog ore	603	1,736
Chalk	2,304,248	2,264,350
Chert, flint, &c.	54,518	66,206
Chromite of iron	140	—
Clays* and shale	6,003,787	5,842,675
Coal	227,748,654	248,499,240
Copper ore and copper precipitate	1,213½	1,159½
Fluor spar	53,408	64,874
Gravel and sand	2,022,567	1,929,164
Gypsum	178,734	173,015
Igneous rocks	3,961,524	4,239,405
Iron ore	14,613,032	14,845,734
Iron pyrites	22,195	8,515
Lead ore	14,784	15,322
Lignite	150	900
Limestone (other than chalk) ..	10,156,603	10,454,717
Manganese ore	17,456	9,942
Natural gas	(c. ft. 85,000)	(c. ft. 85,000)
Ochre, umber, &c.	9,480	11,216
Oil shale	3,080,867	3,117,658
Phosphate of lime	3,372	—
Rock salt	113,884	122,679
Salt from brine	1,862,130	1,890,709
Sandstone	1,553,151	1,613,379
Slate	110,107	121,524
Soapstone	936	1,233
Sulphate of strontia ..	1,014	2,577
Tin ore (dressed)	6,378	6,576
Tungsten ores	302	241
Uranium ore	—	18
Zinc ore	9,025	7,484
Total	273,088,449½	295,401,139½

* Including china clay, china stone, amd mica clay.

The lengthy reports of the Divisional Inspectors deal largely with details of administration. In many instances output was reduced owing to shortage of transport and loss of foreign markets; furthermore, there was a decrease in the output per man.

In regard to coal mines, much attention was paid to the supply of home-grown timber for pit props; steel props are now employed at many collieries, particularly at Newbattle, Scotland, where the roofs of all roads are supported by arched steel girders, together with brickwork in the main roads. Increased efforts were made to combat the danger due to coal dust explosions by the distribution of stone dust and by the provision of dust-tight trams. During the war there was delay in obtaining material for these and other safeguards, *e.g.*, armoured electric cables, required by the Coal Mines Act, 1911. Ventilation is being improved by splitting the main air currents and conducting the air to the coal face. It would appear that since the nitro-glycerin content of gelignite was reduced to 50 per cent. the products of the explosion often contain a larger proportion of carbon monoxide, together with some nitrous fumes. Further restrictions upon the use of naked lights are proposed.

The effect of the war upon the condition of the mines varied in different localities. While attention was concentrated upon output, development work was in many cases retarded, and extensions are now required. Although haulage roadways were kept in good order, it was necessary to cease work in whole districts of some collieries in order to concentrate the available men, and a heavy outlay will be necessary to reopen such districts.

In connexion with hæmatite mines, an investigation is proceeding to ascertain whether iron-ore dust is liable to cause fibroid phthisis.

Report on the Trade of South Africa, 1918. *By H.M. Trade Commissioner at Cape Town. Pp.* 90. [*Cmd.* 357. 6d.] (*London: H.M. Stationery Office.*)

The year under review has been an eventful one, but thanks to the British Navy and Merchant Service, South Africa has been spared the worst effects of the war, and from the economic standpoint the country gained far more than she lost. The curtailment of shipping has caused a considerable development of home industries and of trade with the South-West African Protectorate, East Africa and Zambesi. The epidemic of influenza and the drought at the end of the year affected trade seriously, and there has been much labour unrest; prices have risen enormously.

Prior to the war the trade with South Africa was noted rather for cheapness than quality, but of recent years the increase in spending powers of the working classes (both white and native) has created a demand for better class goods. The agricultural industries are, generally speaking, in a flourishing condition, the area under cultivation having increased enormously. There are, however, still large tracts of virgin land, and it is hoped that a larger white population will be attracted to farming in the future. The scarcity of fertilisers has been a serious handicap, and although South African farmers have learned to dispense with certain products hitherto imported, and the manufacture of sheep dips has been undertaken locally, the Union will continue to rely on imports for its agricultural supplies. Schemes are afoot for installing large grain elevators at Durban, East London and Cape Town, also for extending irrigation work similar to that at the Modder River.

The output of minerals for 1918 was:—Gold, £35,760,000; diamonds, £6,960,000; coal, £3,250,000; copper ore, £360,000; tin concentrates, £450,000; other minerals, £440,000; total value, £47,220,000. The gold industry is passing through a very difficult period owing to the large increase in production costs, while the value of the metal remains at its fixed standard.

The coal output shows a decrease of 1,070,840 short tons over 1917, but the exports have increased from 538,679 to 1,208,386 tons. Recent analyses show that the average steam-raising value of the best Transvaal (Witbank) coal is 12·78 lb. of steam per lb. of coal, and the best grade Natal coal 13·95 lb. Local industries include a new smelting plant for tin which meets all the requirements of the Union.

The chief chemical manufactures include alcohol, ammonia, argol, arsenic, bleach, disinfectants, Epsom salts, glycerin, saccharin, soda, starch, and lead nitrate. The production of chemicals increased in value from £171,040 in 1915–16 to £234,494 in 1916–17. Oxide of antimony has been absorbed locally for the manufacture of paints. The value of varnishes produced in the Union in 1916–17 was £46,420; it is estimated that the South African market for these products approximates to £250,000 per annum. The present demand for cement exceeds the supply. The iron industry at Pretoria and Vereeniging is now established, and pig-iron of good quality is being produced. The following figures give the values of the annual production of the chief chemical industries:—Sugar, £3,065,000; explosives and matches, £1,884,000; breweries, £1,161,000; soap, £882,000; candles, £626,000; tanning, £475,000; distilleries, £382,000; oil and grease, £272,000; and fertilisers £170,000. It is possible that the phosphate deposits at Saldanha Bay may be developed in the near future, but the rock is very high in iron and alumina. It is suggested that British manufacturers could do benefit both to themselves and the Union by starting branch factories in South Africa.

The principal imports are iron and steel machinery, railway materials, and clothing. The total imports for 1918 were valued at £47,397,000, compared with £34,750,000 in 1917 and £38,526,000 in 1913. The chief increases were in cotton piece goods, blankets, chemicals and sugar. About four-fifths of the imports of drugs and chemicals is derived from the United Kingdom. The German trade was formerly about three-fifths that of the British. Importations from the United States have not increased appreciably during the war, but Canada, Japan and Australia have entered the market, and in certain lines will probably retain their position. Glassware has been in short supply during the war, particularly in respect of licensed victuallers' glass. Occasional shipments from Holland and importation of inferior articles from Japan have taken the place of the cheaper wares formerly supplied by the Central Powers; this demand will be large for some time to come. If these Powers are excluded from the South African market, the United Kingdom should have a monopoly for the trade in earthenware and china. Remarkable changes have taken place in the overseas supply of linseed oil. In 1913 the United Kingdom supplied over 99% of the imports, and again in 1915 and 1916; in 1917 these were distributed between U.K. 84%, India 12%, and U.S.A. 3·5%; and in 1918, U.K. 1·8%, India 43·4%, and Argentina 42·4%. America and Canada have been supplying paints, colours and varnishes in increasing quantities since 1916, but with the exception of American paints and leads this competition is regarded as temporary.

Excluding gold, the total value of exported materials was £28,912,736 in 1918, compared with £25,791,923 in 1917, and £26,426,246 in 1913; of these 64·7% went to the British Empire in 1918, against 84·8% in 1913. The shipping position is in a very unsettled state, and large stocks of African produce are held up for want of tonnage. The exports in 1918 and 1913 included:—

	1918.		1913.	
	Quantity.	Value. £	Quantity.	Value. £
Blasting Compounds lb.	3,960,080	156,603	1,057,450	36,567
Diamonds carats	2,571,646	7,063,043	5,503,861	12,016,525
Copper Ore tons (long)	4,665	258,920	7,040	156,748
Do. regulus & smelted tons (long)	1,509	88,330	9,500	292,607
Tin, Block cwts.	1,925	30,146	—	—
Do. ore & concentrates tons	2,156	245,067	2,779	381,042
Wool lb.	115,634,498	9,689,630	176,971,865	5,719,288
Hides & skins lb.	43,679,639	2,082,656	62,580,931	2,010,484
Wattle Bark lb.	107,904,898	287,220	145,717,738	309,329
,, Extract lb.	8,339,459	124,887	—	—
Sugar	5,342,248	70,166	347,244	3,032
Whale Oil galls.	561,577	62,316	2,177,537	122,692

The large decreases in the exports of whale oil during the war were due to a reduction in the number of firms operating, increased local consumption, utilisation in explosives factories, and to the existence of large stocks, the exportation of which was prohibited.

Report of the Commission appointed to examine the conditions of the Iron and Steel Works in Lorraine, in the occupied areas of Germany, in Belgium, and in France. *Ministry of Munitions, July,* 1919. *Pp.* 48, *with maps and plans.* (*London: H.M. Stationery Office.*) *Price* 3*s. net.*

The iron and steel works in Lorraine were very short of fuel during the later period of the war, but those in the Saar Valley continued to work at high pressure. Some of the French-owned works in Lorraine were worked by the Germans, while from works just within the French border plants were stolen and transferred to German works in Lorraine and to Brückhausen. Machinery became seriously damaged through shortage of lubricants, but the effect of bombs was insignificant. Manganese was available only in small quantities, and attempts to use calcium carbide as a partial substitute for deoxidising purposes resulted in the production of a high proportion of waste steel, and powdered anthracite was tried unsuccessfully; in fact, no satisfactory substitute for manganese was discovered.

At the time of the commissioner's visit none of the works was in full operation owing to the failure of the German Government to deliver the full quantity of furnace coke guaranteed under the terms of the Armistice. Only 500,000 tons had been received in Lorraine from Germany, about one-third of the quantity due. There are 68 blast furnaces in the Province of Lorraine, 60 of which were in good condition, but only 5 were in blast at the date of the armistice; since then about 28 had been in blast at one time, but the output was low owing to the dwindling supplies of coke; 13,000 tons of coke is required daily to keep the 60 furnaces in blast, and efforts were being made to secure Belgian coke.

At Moyeuvre, the only coke-oven plant seen in Lorraine, coke was produced from Saar coal mixed with 25 per cent. of Westphalian coal owing to the poor coking properties of Saar coal alone; many ovens in the Saar Valley use a similar mixture. The coke is too friable for transportation, but appeared to be as suitable for furnaces as that produced in Great Britain.

Lorraine iron ore is of two qualities, calcareous and silicious, a self-fluxing mixture of these being used. Average analyses give: Calcareous—Fe 25—30%, CaO 18—20%, SiO_2 7—8%; Silicious—Fe 26—35%, CaO 5—7%, SiO_2 15—20%. The iron content of the ore mixture used runs from 27—33 . The average analyses of the basic pig-iron produced gave Si 0·6—0·8%, Mn 1·2—1·4%, S 0·06—0·07%, P 1·8—1·9%.

Basic Bessemer steel works are attached to nearly all the Lorraine blast furnaces and derive their heat and power from blast furnace gas. In other cases the surplus gas generates power which is supplied to Metz. Two cycle engines of the Klein type were used for blowing purposes and four cycle engines of the Thyssen, Erhardt and Sehmer, Nürnberg, and Société Alsacienne types for power generation. Some of the later steel mills were wholly electrified, part of the power being generated by steam turbines.

Relatively small quantities of foundry iron or of special steels are made. Most of the Lorraine works transport ore from their own mines by aerial ropeway, the average cost into furnace being 8 to 9 francs per ton of ore. Large quantities of steel were stored in well equipped stock-yards connected with the works, the steel-maker acting as his own warehouseman.

The acquisition by France of further supplies of ore should enable her to produce 11,000,000 tons of pig iron per annum to dispose of in competition with other countries. It is estimated that the French production of ore will be 42,000,000 tons, or twice the output in 1913, whereas the German production of ore will only be about 7,000,000 tons, compared with 27,000,000 tons in 1913.

Before the war France imported 20,000,000 tons of coal; she will now be able to obtain increased supplies from the Valenciennes district. The iron and steel makers hope to import English coal or coke in exchange for basic pig iron, but transport and transhipment of coke present difficulties. Possibly Durham coking coal may be mixed with Saar coal and converted to coke in Lorraine. (See also this J., 1919, 380 R.)

Report on Food Conditions in Germany, with Memoranda on Agricultural Conditions in Germany and on Agricultural Statistics. *By* E. H. Starling, A. P. McDougall, *and* C. W. Guillebaud. *Pp.* 48. [*Cmd.* 280. 6*d.*] (*London: H.M. Stationery Office.*)

The Report is based on observations made during two visits to Germany; the places visited were Cologne, Bonn, Coblenz, Trier, Berlin, and Upper Silesia, and these were especially favourably situated as regards food supplies. There is therefore reason to believe that conditions in other parts are still worse than those mentioned below. Before the war Germany produced 85 per cent. of the total food consumed by her inhabitants; this large production was only possible by high cultivation and by the plentiful use of manure and imported feeding-stuffs, means for the purchase of these being furnished by the profits of industry. During the war this importation was cut off, and the greater part of the home-produced nitrogenous artificial manure was applied to the manufacture of explosives. The productivity of the soil, consequently, diminished by 40 per cent., a decrease which, during the last few years, has been accentuated by climatic conditions, and the quantity of the live stock has been reduced by 55 per cent. There has been a serious shortage of food in Germany, beginning in the summer of 1916 and lasting to the present time (1919), and the starvation of the population has caused a great loss of body weight and diminished resistance to disease. The death-rate has increased and the birth-rate declined, so that the number of deaths now considerably exceeds the number of births. There is a widespread increase of tuberculosis, the deaths from this disease having increased, according to the locality, from 2·5 to 6 times. Owing to lack of milk, rickets and associated diseases are of common and increasing occurrence. So great is the scarcity of food in Germany that during the coming year she will require, if she is to be restored to a condition in which she can put forth her total working capacity, imported food to the extent of eight billion calories, that is, about one-quarter of the amount imported by the United Kingdom. Manufactures and businesses are paralysed by the lack of raw material, of capital, and of confidence, but the highly efficient organisation, human and material, which made Germany so successful as a producing concern, is still intact. Of raw materials, among the chief requirements are cotton, wool, flax, leather, iron ore and certain other ores; some manures and concentrated feeding-stuffs are immediately necessary. Of foods, fat is particularly required; for the next six months the country can live on the proceeds of this harvest. There are large reserves of coal in Germany, which are at present unexploited, but until this occurs, the loss to Germany of 40 per cent. of her former coal output must diminish the number of workers who can be maintained. Germany is at present over-populated, and it is probable that during the next few years

many million workers (according to some estimates as many as fifteen million) will have to emigrate owing to lack of work and food. It is considered that, in order to obtain payment of the reparation demanded by the Allies, the first essential is to provide working capital for re-starting the mechanism of production in Germany. Numerous statistical tables and charts are given as appendices to the Report.

OFFICIAL TRADE INTELLIGENCE.

(*From the Board of Trade Journal for Oct.* 23 & 30.)

TARIFF. CUSTOMS. EXCISE.

Australia.—Certificates of origin are required in respect of goods imported from Scandinavia, Denmark, Holland, Finland, Switzerland and the reconstructed States which formerly formed part of the Austrian Empire.

Belgium.—Among the articles imported from Germany for which certificates of origin and import licences are no longer required are asbestos ware, celluloid, cork, dephosphorisation slag, emery, carborundum, gums, hides, skins, laboratory glassware, scientific instruments, metal tubes, crude minerals, fats, oils, pitch, plaster, resins, rubber, and wood.

Brazil.—A copy of the new Draft Tariff may be seen at the Department of Overseas Trade.

Bulgaria.—Among the articles which may now be imported are tanning extracts, petroleum, mineral oils, and shoe leather. Among the commodities needed, and for which permits will be issued as soon as conditions allow, are chemicals, dyes, paints, varnish, fats, oils, waxes, drugs, medicines, metals, paper, skins, leather, and scientific instruments.

Finland.—The restrictions on the importation of fertilisers have been removed.

France.—The customs duties on sugar and certain articles containing sugar have been increased.

France and Algeria.—The French Senate has adopted a Bill, previously adopted by the Chamber of Deputies, authorising modifications in the Customs Tariff in respect of chemical products, and admitting free of import duty the German dye stuffs, drugs and chemicals that form part of the levy imposed on Germany by the Peace Treaty.

Germany.—Recent customs decisions affect sheet glass, cocoa beans, rubber, asbestos, and vegetable fibres.

Jugo-Slavia.—Among the articles exempted from import duty for one year from October 5 are lubricating oils, fuel oils, and auxiliary chemicals and dyes required by the manufacturing industries.

Minimum rates of customs duty are applicable for one year from the same date, to, *inter alia*, printing and writing paper, printing ink, pencils, bottles, jars, and laboratory apparatus.

Minimum rates for six months from the same date apply to chemicals, medicines, and all products used for treating disease.

Netherlands.—The prohibition of the export of acetic acid and raw jute has been temporarily raised.

New Zealand.—It is proposed to levy a surtax on nearly all classes of goods of late enemy origin.

Poland.—The revised import and export regulations are given in the *Board of Trade Journal* for October 30. Among the articles which may be imported without permit are foods, china clay, chalk, potash, silica, sand, borax, celluloid, rubber, cork bark, many metals, scientific instruments, certain chemicals, photographic articles, soap (except toilet soap), and matches.

Portugal.—The customs duty on heavy mineral oil for fuel is fixed at 34½ escudos per metric ton.

Spain.—Recent customs decisions affect sulphur black, iron ingots, iron and steel "tochos," iron and steel bars and plates, and tinplate.

Sweden.—Export prohibitions have been removed from, *inter alia*, oil-seeds, spirits, liqueurs, wines, and glycerin.

Tunis.—Special export licences are required, as from September 12, for organic manures, molasses, glucose, nitrates of lime and soda, cyanamide, sulphate of ammonia, superphosphates, dephosphorisation slag, and chemical manures.

Import prohibitions are still in force for wines, spirits, liqueurs, mineral illuminating oil, compound medicines, vegetable fibres (except cotton), and paper money.

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 4, Queen Anne's Gate Buildings, S.W. 1, from firms, agents or individuals who desire to represent U.K. manufacturers and exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

Locality of firm or agent.	Materials.	Reference Number.
Australia	Glass, china, pottery	908
,, ...	Chemicals	912
British India ..	Soap, candles, boot polishes, etc.	915
British West Indies	Paraffin candles	883
,,	Carbonic acid gas..	884
,,	Corrugated galvanised iron ..	886
,,	Portland cement	887
,,	Fertilisers	888
Canada	Glassine, greaseproof and parchment papers	937
Egypt	Paper	947
New Zealand ..	Heavy chemicals, salt, tinplate, glass jars, dyes, soap, cod oil, olive oil. greaseproof and parchment papers	940
,, ..	White lead, linseed oil, plate and sheet glass, lubricating oils and greases	941
South Africa ..	Heavy chemicals, superphosphates	944
Belgium	Photographic apparatus	951
,, ...	Iron ore, bricks, machinery, etc...	953
,, ...	Sanitary ware, earthenware, tin foil	*4692 T and R
Denmark ..	Glass, pottery, soap, margarine, salt, petroleum	956
Germany	Soap, soda, margarine	892
,, ...	Cattle cake	893
Greece	Chemicals, paper	959
Italy	Glass, china, crockery, toilet soap	896
Netherlands ..	Tanning extracts	961
Norway	Oils, paints	962
Serbia	Machine oils (catalogues of) ..	965
Spain	Sanitary ware, pottery	901
,, ...	Linseed oil, emery paper ..	967
,, ...	Chemical fertilisers	969
,, ...	Chemicals, pharmaceutical products	970
Switzerland ..	Toilet soap, pharmaceutical goods	902
Algeria	Soap, mineral and vegetable oils..	972
United States ..	Leather	974
Brazil	Chemicals, cement	906A
,, ...	Perfumery	977
Chile	Drugs, perfumery	978
Peru	Paper, paint, varnish, glass, earthenware	981

* Belgium Trade and Reconstruction Section, Regent House Kingsway, W.C. 2.

Removal to New Offices by the Board of Trade.—The headquarters of the Board of Trade is being removed from Whitehall Gardens to Great George Street, Westminster, S.W. 1. Among the departments already transferred are those dealing with Commercial Relations and Treaties, Industries and Manufacturers, and the Power, Transport and Economic Department.

TRADE NOTES.

FOREIGN.

Industrial Fairs in Switzerland.—It has now been agreed that exhibitions of foodstuffs and of articles connected with agriculture shall in future be held at Lausanne, while samples of products connected with all other industries are to be exhibited in Basle. Exhibitors at Lausanne may, if they desire, exhibit in Basle in any groups of products other than those of foodstuffs and agriculture. For the present the Lausanne exhibition is to be held in the autumn.—(*Schweiz. Chem.-Zeit., Sept.* 24, 1919.)

The Swiss Soap Industry.—This industry suffered many hardships during the war period. Raw materials were difficult to procure even at enhanced prices, and owing to formalities and regulations connected with importation, goods were held up for many months, causing losses in weight during storage. These factors combined to send up the price of soap several hundred per cent. Although on the whole the supplies of raw materials were not much below those of pre-war days, there was a remarkable shortage of the finished article. The supply of alkali from the Sodafabrik Zurzach was continually increased, and the country achieved independence in this respect.

Before the war Switzerland imported 90 per cent. of its requirements of household soaps from France. In 1916, 33 per cent. was derived from Spain, in 1917, 4 per cent., during the first half of 1918, 90 per cent. came from this source. Before the war 20 per cent. of the toilet soaps was imported from France, and 60 per cent. from Germany; in the last year of the war 60 per cent. was imported from France.—(*Schweiz. Chem.-Zeit., Aug.* 27, 1919.)

Dutch Match Factories.—According to a report of the German Consul-General in Amsterdam, the Dutch match factories are to be amalgamated into a single joint-stock company, in which the State will be interested. The capital of the company will be one million florins (£83,333), and a considerable part of the profits will go to the State when these are in excess of the amount necessary for the payment of a certain dividend on the capital. The price of matches is to be fixed by law.—(*Schweiz. Chem.-Zeit., Sept.* 10, 1919.)

The Skoda Works.—The French firm Schneider-Creusot has purchased 40,000 shares in the Skodawerke A.-G. in Pilsen, which was recently nationalised by a vote of the General Assembly. The directorate includes six Czechs, Eugène Schneider and two other Frenchmen. The company will in future bear the title "Akt.-Ges. vormals Skodawerke," and the share capital is to be raised from 72 to 144 million kronen (3 to 6 million pounds at normal exchange).—(*Stahl u. Eisen, Oct.* 23, 1919.)

Crude Phosphate Situation in Italy.—The war has stimulated food production in Italy and consequently increased the demand for fertilisers. Phosphate is obtained chiefly from Tunis, but the Minister of Agriculture states that the Government, though not itself a purchaser, will encourage the importation of American phosphates. There are, however, financial difficulties owing to restricted buying power of manufacturers, and long terms of payment are necessary. The maximum prices to be charged the farmer per unit of citric-soluble phosphoric anhydride vary from 1·37 to 1·40 lire (1s. 1d.—1s. 1½d. at normal exchange) according to position. The phosphates, in canvas sacks of 100 kilo., must meet requirements as to dryness, pulverisation and homogeneity.—(*U.S. Com. Rep., Sept.* 9, 1919.)

The Cacao Crop in the Dominican Republic.—The Dominican cacao crop has been unusually good this year, the yield being estimated at 35,000,000 lb., to which is to be added that of the second crop in October and November. The crop would have been even greater but for the substitution of tobacco in some areas. The price is 18 to 20 cents per lb. inland, and 20 to 21 cents at seaports. Most of the cacao is shipped to the United States, and a small proportion to Europe.—(*U.S. Com. Rep., Sept.* 5, 1919.)

Japanese Foreign Chemical Trade.—During the last three years there has been a remarkable development in the Japanese chemical industries. Although certain chemical and dye works have suffered much owing to shortage of raw materials, the total production has increased enormously and the export values have risen *pari passu*. In the earlier years of the war the exported value of but very few chemical products exceeded ten million yen (£1,000,000 approx.), but now there are seven on the list.

Export Values (in Yen) of Chief Chemical Products, 1916—1918.

	1916.	1917.	1918.
Paper and paper goods	14,350,804	22,118,613	37,430,977
Vegetable and fish oils	8,071,027	16,292,761	27,919,893
Matches	21,193,193	24,585,967	27,742,663
Sugar, refined	17,430,709	27,612,599	25,273,459
Porcelain	12,103,993	14,473,934	19,957,782
Glassware	13,203,361	20,928,431	19,593,046
Spirit and soy	5,888,882	8,484,757	11,115,830

The total values of exported chemicals in the three years amounted to Yen 134,647,836, 190,258,338, and 241,537,267 respectively. Although the foreign market for sulphuric acid was lost, the exports of the following substances showed continuous increases:—Camphor, sulphur, acetic acid, potassium iodide and chlorate, bleaching powder and calcium carbide. On the other hand, the imports of raw materials for the chemical industries also increased considerably. The following are the most striking examples:—

Import Values (In Yen) of Raw Materials etc., 1916—1918.

	1916.	1917.	1918.
Oil cakes	37,470,492	55,435,279	91,499,726
Sugar, crude	12,984,734	11,699,701	33,525,914
Mineral oils	12,290,602	12,292,126	22,817,127
Copra	3,394,965	8,251,282	15,633,856
Vegetable oils	6,690,357	8,008,718	14,774,585
Rubber & gutta-percha	7,246,007	9,130,225	12,948,236
Hides, raw	8,930,210	5,841,410	11,980,455
Soda ash	3,698,440	9,964,120	11,405,021
Saltpetre	6,184,862	9,724,626	11,294,911
Dyestuffs	3,437,584	4,535,986	11,238,021

The percentage proportion of the chemical exports and imports to the total foreign trade of Japan was as follows:—

	1916.	1917.	1918.
Exports	12·1	12·0	12·5
Imports	22·5	19·6	19·9

Thus the ratio of exports is tending to increase and that of imports to diminish. (*Cf.* this J., 1919, 339 R.)

COMPANY NEWS.

NEW COMPANIES & NEW CAPITAL ISSUES.

Evans, Sons, Lescher and Webb, Ltd., wholesale drug manufacturers, has recently offered for public subscription 150,000 ordinary shares of £1 at 30s. per share. The issue was over-subscribed three and a-half times.

The National Mining Corporation, Ltd., with an authorised share capital of £3,000,000 in £1 shares, two-thirds of which has been subscribed for by the directors and their associates, is offering 500,000 shares at par to the public. The Corporation will, it is hoped, effect financial co-operation among the leading mining houses of this country.

Lever Bros., Ltd., is issuing 4 million 7 per cent. cumulative "C" preference shares of £1 each at par in order to provide for the cash consideration in respect of the purchase of over 90 per cent. of the share capital of Price's Patent Candle Co., Ltd., and the whole of the ordinary shares in Joseph Crosfield and Sons, Ltd., and William Gossage and Sons, Ltd., and for developing the company's business generally.

Baldwins Ltd., iron and steel manufacturers, etc., is issuing for sale at par 1,000,000 5 per cent. cumulative "B" preference shares, free of income tax up to 6s. in the £. The company has an authorised share capital of £7,000,000.

Agricultural Industries, Ltd., has been formed with an authorised share capital of £2,000,000, divided into 1,700,000 6½ per cent. cumulative preference shares of £1 each, income tax free, of which 1,200,000 are now offered at par, and 3,000,000 2s. ordinary shares which are offered at 5s. per share.

The interests of the chief German companies working the diamond fields in the South-West Africa Protectorate are to be sold to a new company to be registered at Cape Town as *The Consolidated Diamond Mines of South-West Africa, Ltd.*, with a share capital of £3,750,000. The purchase price is said to be £3,500,000.

REVIEWS.

The Simple Carbohydrates and Glucosides. *By* E. Frankland Armstrong. (Monographs on Biochemistry, *edited by* R. H. A. Plimmer *and* F. G. Hopkins.) *Third edition. Pp.* x+239. (*London: Longmans, Green and Co.* 1919.) *Price* 12*s. net.*

The chemistry of the sugars is a branch of our science which has had a voluminous literature from quite early times, in which, however, with but few exceptions, there was no order or system until the publication of the memorable researches of Emil Fischer, the chief of which appeared between 1884 and 1908. Fischer's work had its starting-point in the observations of Kiliani on the respective constitutions of dextrose and lævulose, and led to the development of our knowledge of the sugars from a state of comparative chaos to one of the most highly systematised sections of so-called organic chemistry. Following in this great chemist's wake, moreover, numerous other chemists, including his own students, have contributed their quota to the erection of the now proud edifice.

Researches which have led to the development of modern sugar chemistry must be ranked among the most brilliant achievements of the chemist, the value of which to mankind can scarcely be appraised—certainly not exaggerated. In support of this thesis we may instance the physiological importance of the carbohydrates as food materials, and the fundamental significance of their formation in nature to the whole of aërobic life. In regard to those industries concerned with the manufacture of sugars, the utility of recent chemical researches on the subject may not at first sight be quite apparent. Sugar extraction and manufacture from sugar cane is an art centuries old, whilst the beet sugar industry dates back more than a hundred years. Throughout their history the sugar industries have been aided by physics, engineering, botany and chemistry. That branch of the chemistry of the sugars with which the present monograph is concerned has, however, only comparatively recently come within the purview of the technologist. Some of the sugars first brought to our knowledge by synthetic methods in the laboratory will probably be found in nature, whilst one at least has been detected in molasses; glutose, for example, is said to be present in cane molasses to the extent of 1—5%. Moreover, the susceptibility of the sugars to undergo changes by chemical and physiological agencies is alone a sufficient argument that the modern manufacturer must acquire as complete a knowledge as possible of the chemistry of the subject. That this has been fully recognised is shown by the fact that in most works on sugar manufacture and on sugar analysis published recently due attention is paid to contemporary chemical researches.

Dr. Armstrong's monograph is concerned essentially with the history of modern work on the subject. The first edition appeared in 1910 and covered 112 pages, whilst the second was published in 1912 and covered 170 pages. That a third edition, extended by 69 pages, has been demanded is in itself an ample tribute to the value of the work. The present work consists of an introduction, nine chapters, a bibliography, and an index.

Glucose or dextrose and the hexoses in general are dealt with in the first two chapters. Since of the sixteen possible aldehexoses fourteen have been obtained by synthesis, whilst only three have been found in nature, there is here much scope for further research. The γ-oxide formula (with a pentophane ring) for glucose, assigned to it by Tollens in 1883, has been found to coincide with the behaviour of the sugar in its α- and β-modifications as well as with the derived glucosides. It will be remembered that Fischer in the preparation of the α- and β-methyl glucosides obtained as a by-product a syrup from which he separated a third methyl glucoside. According to the more recent work of Irvine Fyfe and Hogg, this substance consists of two isomeric glucosides, which appear to be β-oxides with a triphane ring. Special attention is called by the author to the significance of this observation, which has led to the conclusion that a third form of glucose exists much more active than the γ-oxide forms. Mutarotation, which was first explained by Lowry in 1899, is fully discussed, as well as the work of the author himself and that of C. S. Hudson on the subject. Chapter III. is concerned with mannose, galactose, fructose, sorbose, the pentoses, and the carbohydrate alcohols. A description is also given of the inositols or cycloses.

Chapter IV. deals with the disaccharides. Since the glucosidic constitution was suggested for these compounds by Fischer, we have certainly a more precise notion of their configurations. Ingenious as the arguments are, however, which have led to these formulæ, it is questionable whether they will help us much in effecting their syntheses. It was, we believe, one of the great ambitions of Emil Fischer to synthesise sucrose, yet this was never realised. The trisaccharides and the tetrasaccharide, stachyose, are also described in the chapter.

We are introduced to the biochemical phase of the subject in Chapter V. Evidence has long been furnished that there is sometimes at any rate a combination between enzyme and substrat. Fischer, without going so far as this assumption, likened the relation of an enzyme to its substrat to that of a key to a lock, whilst H. E. and E. F. Armstrong have carried the simile further, suggesting that the combination of enzyme and sub-

strat (and for this there is now experimental evidence) may be compared to the way in which the successive fingers of a glove fit on to a hand.

In Chapter VI. hydrolysis and synthesis are discussed. It will be remembered that v. Baeyer suggested in 1870 that formaldehyde is the first product of assimilation of carbon dioxide and water by green leaves in sunlight, and evidence in support of this has been obtained by Bokorny and by Usher and Priestley, and confirmed by Schryver. All this is noted, as well as the observation of Brown and Morris in 1893, that sucrose is the first sugar to be synthesised by the assimilatory process. This we believe has been confirmed by several subsequent observers. Dr. Armstrong rightly refers to the discovery as "unexpected," and in all probability there is at least one intermediate compound formed between formaldehyde (assuming this to be the first product) and sucrose—possibly a hexose. But it must be remembered that non-reducing carbohydrates—sucrose, starch, and the like—as well as many heterogeneous glucosides—*cf.* p. 188 of the monograph—function in plants as true reserves or resting compounds. The occurrence of reducing sugars in ripening fruits cannot be cited against this view, as here a dynamic and not a static set of conditions reigns.

A most interesting and full account is given of the natural glucosides in Chapter VII., whilst the synthetic glucosides are dealt with in Chapter VIII. The last Chapter, IX., is one of the most suggestive in the monograph. Covering but 14 pages, it puts forward what would seem to be most plausible explanations of the significance of glucosides in metabolism, their products of hydrolysis other than the sugars by specific enzymes stimulating katabolic changes such as normally take place at night. Respiration in plants and the ripening of fleshy fruits is discussed in the same light. The text is based on the researches of numerous observers, among which those of H. E. and E. F. Armstrong (1910-1912) figure largely.

The bibliography is an important feature of the monograph.

We may say of Dr. Armstrong's monograph that it is a useful compilation and fulfils its objects. It cannot fail to prove of great value to future workers on the subject.

Arthur R. Ling.

Calculations used in Cane-Sugar Factories.—*A practical system of chemical control for the sugar houses of Louisiana, the tropics, and other cane-producing countries. By* Irving H. Morse. *Second edition, re-written. Pp.* 189. (*New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd.*, 1917). *Price* 9*s.* 6*d.*

The original edition of Irvine H. Morse's very useful little book on calculations used in cane sugar factories appeared in 1904. The second edition, which has just been issued, has more than doubled in bulk.

Although the author has had experience in Cuba, his calculations are mainly concerned with conditions and problems as they exist in Louisiana, where the cane never ripens and where early frosts must be reckoned with. Nevertheless it contains so much of general value that a second and up-to-date edition will be welcomed in all cane-producing countries. In this connexion it might be well to direct attention to the need for more consistency in the methods of expressing measurements in cane sugar calculations. Not only do Spanish-speaking manufacturers and growers buy and sell their cane by the *arroba* of 25 lb. Spanish weight, but the Spanish pound equals 460·1 gms., whereas the American (and English) pounds are equivalent to 453·6 gms. Further, the American gallon of 8·331 lb. and the English gallon of 10 lb. are both employed. Finally, in Louisiana the yields are expressed in pounds per ton of cane, and not as in all other countries as per cent. of cane.

This book does not lay claim to being a textbook of sugar analysis, but it contains many, though necessarily brief, directions, together with a very complete set of tables. A very important feature of Mr. Morse's publication is his system of drawing up laboratory reports.

Two problems of economic interest, namely, the two-factory system and the payment of cane by the "unit" system, are dealt with rather fully. Dr. Geerligs has shown very clearly that whenever the cane is allowed to mature thoroughly, as is the case in the tropics, the sugar will be evenly distributed throughout the whole length of the cane. In Louisiana, on the other hand, where the period of growth of the cane is a short one, extending from March to October or November, the greater part of the sugar is found in the lower joints. When immature cane is ground a serious loss occurs from the extraction of sugar from the upper half, but a handsome profit from the extraction of sugar from the lower half. The only sound solution of the problem is undoubtedly to manufacture the upper half into syrup and the lower into sugar. The method of paying for cane by the "unit" system, to which Mr. Morse devotes a whole chapter, depends on the principle of paying according to the intrinsic value of the cane. This unit may be defined as a figure which when multiplied by the price of granulated sugar and the percentage of sucrose in the juice will give the total income to be expected from a ton of cane. This method is fair to both grower and manufacturer, as the price of cane increases or decreases in direct proportion to the value of the commercial products obtained. A brief reference is made to the effect of the war on the cane industry and the problem of the production of cheap sugar. He maintains that it will be met by the introduction of the two-factory system already referred to, and the discovery of an economic process for making standard granulated sugar direct from the cane.

Though dealing to a large extent with problems more definitely connected with Louisiana, the accurate and well-arranged information which the book contains will always be useful; and the many problems discussed will be read with great interest by all associated with the sugar industry.

F. V. Darbishire.

Messrs. Longmans, Green & Co. announce that Dr. J. W. Mellor has been engaged for the last twelve years on the preparation of a compendious survey of inorganic and general chemistry. The complete work will probably consist of six volumes, the first of which is now in the press for publication early next year.

PUBLICATIONS RECEIVED.

Iron Bacteria. *By* D. Ellis. (*With 45 illustrations and 5 plates.*) *Pp.* 179. (*London: Methuen and Co., Ltd.*, 1919.) *Price* 10*s.* 6*d.*

The Profession of Chemistry. *By* R. B. Pilcher. *Pp.* 199. (*London: Constable and Co., Ltd.*, 1919.) *Price* 6*s.* 6*d.*

A Bibliography on the Roasting, Leaching, Smelting and Electrometallurgy of Zinc. *Compiled by* H. L. Wheeler. *Bulletin No.* 3, *Vol. IV., of the School of Mines and Metallurgy, University of Missouri, revised to June,* 1919. *Pp.* 386. (*Rollo, Missouri*, 1918.)

Corrigendum.—In the last issue, p. 395 R, line 44, in lieu of "Meyers," read "Miers."

NOTES ON THE RHINELAND CHEMICAL WORKS.

J. ALLAN.

Part. II.—Labour Conditions and Recent Plant Extensions.

It has frequently been said that cheap and docile labour has been a great factor in the success of German industry generally, and that it has contributed not a little to the advancement of their chemical manufacture. A statement of past and present conditions therefore may not be without interest, but it should be emphasised that any existing conditions are probably transitory, and that it is impossible to forecast the state of labour in the future either in Germany or elsewhere. In pre-war times long working hours were general throughout Germany, though there was a growing tendency to curtail them, and the "good firms," so named, which did not necessarily mean the large firms, were adopting "English" time as it was called, which meant working to 12, 1, or 2 o'clock on Saturday instead of the 5 or 6 o'clock which was formerly the rule. Wages in the chemical industry were peculiarly variable. there being apparently no fixed rates in different factories, and in certain districts of a rural character, where it might be thought low rates would rule they were higher than in more populous areas, though many exceptions to this might be found even in contiguous works in the same neighbourhood. The case of one of the large works may be cited as a general example of the change which has taken place both as to the cost and character of the labour supply. Under pre-war conditions a 66-hour week was common, and the rate of pay for general labour was 0.65 marks per hour or a weekly wage of 43 marks. Since then the 8-hour day has been forced upon employers, and for similar labour the hourly rate has risen to 1·7 marks, which means a weekly wage of 81·6 marks, a 90 per cent. increase in the total wages earned with a reduction in working hours of almost 28 per cent. If it be assumed that the output of work per man per hour has not changed, and chemical processes as a rule cannot be accelerated, it follows that the labour cost for the same output of work as formerly has risen to 112 marks, an increase of no less than 160 per cent. It is quite commonly asserted, however, and it is plainly evident, even to a casual observer who was familiar with pre-war conditions, that the character of the labour has considerably altered both as to subservience to discipline, and the quality of the work done. Lack of attention to instructions and carelessness are common, and the general assertion is that the possible output is now only about one-half of what it was. It is probable that this statement includes the reduction following upon the lessened number of hours worked, as well as that arising from lowered efficiency, as figures derived from industry, such as certain branches of engineering, where output can be carefully determined by the number of articles produced, show a minimum reduction in output per hour of about 25 per cent. How much of this arises from the fact that for reasons of policy the works generally are employing, or more correctly are paying, their pre-war labour force, whilst their actual output is in some cases as low as 10 per cent. of the possible, cannot be determined; it may be assumed that, with fuller employment, present conditions will be modified, but one cannot help feeling that the old conditions will not return, and that the difficulties surrounding present-day labour problems are not to be confined to Britain alone.

In speaking of output, however, some notice must be taken of the present condition of the German factories, and especially of the changes which have taken place in them during the long period of war. All of the factories having facilities for the manufacture of materials for explosives or gas warfare have greatly increased their plants during this time. It is quite evident also that these additions have been made in no haphazard fashion, but that full consideration has been given to the possibility of using these essentially war additions to the buildings and plant for industrial purposes when the war demand had ceased.

In general, and in the case of the large plants certainly so, it has been left to the factory control to provide for the increased output by such means as they chose to adopt, the Government affording every facility in the matter of materials and labour and, it is stated, also providing the money required for the erection of the plant. The system of financing these extensions has apparently been that of repaying from time to time the expenditure incurred, and cases are not wanting in which large new plants have been erected on Government behalf at a late period in the war in which these repayments have not taken place, and firms are now in possession of very expensively erected buildings and equipment which they would not have built in normal circumstances.

There is a generally expressed fear that the abnormal cost arising from the circumstances in which these extensions were carried out will not be met by the new government, and that the factories will have to bear the major portion, if not the whole, of the charges thus incurred. This of course only applies to work carried out during a late period of the war, and many enlargements of plant have taken place which the erectors have obtained on such terms that capital charges upon their peace output will not be excessive. Probably no better example of the permanent character of these hurried extensions is to be found than the Dormagen plant for the production of picric acid and TNT belonging to the Bayer company, which is situated on the left bank of the Rhine and a little way removed from Leverkusen, which is on the opposite side of the river. The buildings which were begun late in 1916 are all solidly constructed of brick and ferro-concrete, the sulphonating and nitrating houses following in detail the general plan which has been adopted as the standard for such work in the Bayer plants. Two units for the manufacture of picric acid were completed, each having a capacity of about 900 tons per month, and the first of these units was in operation within six months of the commencement of erection.

The nature of the buildings and the substantial and finished character of the plant leave no doubt whatsoever that they are intended to be a permanent addition to the Bayer factories, and with very little alteration they can be converted into a large installation for the manufacture of intermediates and dyes. The plants of the dye-producing firms are in excellent condition, and in many cases have been considerably added to in producing power during the period of the war. If competition with German dyes and pharmaceutical chemicals was difficult in pre-war periods, it certainly will be no less so in the era which is opening before us, if efficient plants and large scale production are the important factors in production costs which we all know them to be.

The term "a chemists' war" has been applied over and over again to the great struggle which we have just passed through, and in no sense is the application of the term more true than when it is applied to the fact that without the plants erected in her chemical works for the fixation of atmos-

pheric nitrogen the resistance of Germany would have broken down at a comparatively early date. As an instrument of peace or a weapon of war, such plants are almost invaluable, and the peculiar independence of Germany from the supply of Chilean nitrate is one of her greatest national assets. It is said that the German Government, at the instigation of her military experts, adopted the position of foster mother to the various processes which were being developed in the country in pre-war times.

Their maternal instinct was roused only by the effect which the supplies from these plants would have upon their military needs, and it would appear to be something more than coincidence that the first steps towards initiating a great European conflict were not taken until the Haber process, with its immense possibilities, had been fully established on a large scale by the Badische Co., and that plants were also in existence for the production of ammonia from cyanamide. Important as nitrates are as a provision for war, their value as affecting the foodstuffs of a nation needs no argument, and it may yet be the case that the now generally decried militarism of Germany has given to the country a boon whose worth is inestimable

The plants at Oppau and Merseburg, in which the direct synthesis of ammonia from hydrogen and atmospheric nitrogen is effected, are enormous in their dimensions, and a monument to the skill of the chemists and engineers who have erected them. Similar words may be applied to the plants at Höchst and Leverkusen, in which ammonia is oxidised to nitric acid, and the imposing sight of the interior of the building at Höchst, which houses 256 platinum catalyst vessels with their various connexions, is one which a chemist cannot easily forget. The capacity of this particular plant is 8000 tons of HNO_3 of 100 strength per month, so that approximately 1 ton of HNO_3 is produced by each catalyst vessel per day. The whole installation, with its plant for vaporising ammonia, fans, catalyst vessels, absorbing towers and nitric and sulphuric acid concentrating plants is an outstanding example of the mass production policy which has been so largely adopted by the German chemical firms as a means towards reducing production costs.

A striking feature of this and very many plants for other purposes is that though in the aggregate the output is very great, the plants themselves consist of many units, each of which is a complete plant in itself, and enlargement of output is arrived at by erecting a fresh series of units rather than by increasing the size of the constituent parts of the unit.

The benefits which arise from this system are many, since it is possible to erect a plant of large capacity from a minimum of drawings and patterns, and the ordering and construction of parts become simple. Also it allows of the use of appliances of standard dimensions which are generally kept in stock by iron founders, earthenware manufacturers and the like, so that time is saved in erection as well as in cost, since the parts which call for special construction are reduced to a minimum in number. It might be mentioned that the plant just spoken of, which was completed and put into operation in February, 1918, cost £2,000,000, and was erected in six months.

Another matter which is forced upon one's notice in these large works is the fact that though the variety of their products is great, there is no reckless plunging into the manufacture of an article which is not connected in some way or another with what is the essential part of their business. As an example of this, we may consider a few of the operations of the Bayer Co. at Leverkusen. It would appear at first sight that the manufacture of superphosphate of lime was clearly dissociated from the essential business of the factory, *e.g.*, the manufacture of dyes and pharmaceuticals. Nevertheless, a superphosphate plant, having a capacity of 50,000 tons per annum, was built and brought into operation shortly before war opened. The reason for this departure was the fact that a large quantity of weak and contaminated sulphuric acid is produced in many of the plant operations which could be made re-usable for such purposes only after being purified and re-concentrated, processes which are costly in time and labour and wasteful of material, since much organic matter has to be oxidised at the expense of the sulphuric acid it is desired to recover. To use new acid for the prime factory processes and waste acid for the purpose of rendering phosphate rock soluble is therefore a perfectly connected development of their business.

Another example: it would appear that the manufacture of 800 tons per month of the mixture of zinc sulphide and barium sulphate known in the paint trade as "lithopone" was outside the field of the manufacture of organic chemicals, but the extensive use of zinc dust for reduction purposes provides the key to this seeming departure from connected extension of the manufactures, since the solution of zinc sulphate obtained from these reductions is the starting material for the preparation of lithopone. An endeavour to recover the sulphur in precipitated calcium sulphate which accumulates in large amount in such a factory is a clear extension of their business, and besides is fraught with immense possibilities, since success in doing so would place an enormous amount of material at hand for the manufacture of sulphuric acid in the shape of the large natural deposits of gypsum. This process is actually being worked on a large scale, but complete success is not yet attained, although several thousands of tons of calcium sulphate have actually been passed through the plant.

As already indicated, a valuable aid to the development of manufacturing processes in the Rhineland area is the great beds of brown coal which lie a little way removed from the river, between Cologne and Crefeld. The ease of working these beds permits of power being obtained at very low cost, and there are several large power stations situated right on the beds which have distributed power to consumers at about 1/5d. per unit in pre-war times, and to-day the cost is stated to be only 2/5ths of a penny.

The Stickstoffdünger Fabrik, which manufactures carbide and cyanamide at Knapsack, in the brown coal area, formerly produced power at slightly less than 1/10th of a penny per unit in its own power station, but recent increased labour and material charges have raised this cost to the still very low figure of less than 3/10ths of a penny per unit. It is not to be wondered at that the development of electrical furnace work and electrolytic processes has been great, and it is difficult to see how competition with these is to be met unless the projected central power schemes proposed for this country can distribute power at equally low rates.

I have already commented upon the great amalgamation of interests which enabled both internal and external competition to be stifled so effectively. This *rapprochement* has had the effect of bringing firms of very diverse interests into extremely close working touch with each other, and whilst similar cases may be found in this country, it may not be without interest to quote some examples of this in German works. As is well known, a process for the synthetic manufacture of acetone was worked out in this country which involved three catalytic operations, viz., the production of acetaldehyde from alcohol, the oxidation of this aldehyde to acetic acid, and the subsequent conversion of the acetic acid into acetone. In the similar process worked in Canada, the first stage was the preparation of acetaldehyde from acetylene.

A pressing demand in Germany for acetic acid led to the establishment of a similar process at the

Farbwerke Höchst, the acetylene being prepared from calcium carbide supplied by the Stickstoffdünger Fabrik at Knapsack. It was apparently early appreciated that it would be highly economical to carry out this process in close proximity to the Knapsack works, since the carbide could then be obtained on the spot, and further, the oxygen required for the oxidation could be obtained from the Linde apparatus, which supplied atmospheric nitrogen to the cyanamide plant in the Stickstoffdünger factory, this oxygen having been practically all returned to the air. This realisation was so far acted upon that a plant belonging to and entirely operated by the Farbwerke Höchst staff was erected within the Stickstoffdünger works, and the separate property of this plant was so far maintained that even the most highly-placed officials of the Stickstoffdünger factory were not allowed access to it. Other cases of a somewhat different nature may be cited. The large ammonia oxidation plant at the Leverkusem works of the Bayer Co. used an oxidising catalyst supplied by the Badische Co., and although the Farbwerke Höchst operates a large plant for the manufacture of hydrosulphites, the quantity of the latter which was used at Höchst in the manufacture of salvarsan came from the Badische factory at Ludwigshafen, because, it was said, of its special purity.

Thus far we have considered, in the main, the great factories which are undoubted models of equipment and control, but there are many others on an entirely different scale, and it must also be said some as badly equipped as the most antiquated of any of our English factories, and this is particularly the case with some of the works engaged solely in making heavy chemicals.

Many others of these smaller works are as efficiently operated as the large ones, and on their own scale are as well provided with plant and scientific control. A peculiarity of German chemical manufacture is the large number of very small firms engaged in the preparation of a very few substances. Their output is invariably specialised in character, the processes used, as a rule, yielding no by-products. Some of these businesses are so small as to be almost one man concerns, the owner of the business being at once works manager and salesman, his factory being erected in what would have been the garden of his house; indeed, in some cases it is in the house itself.

It is probable that the large number of men who have received chemical training is responsible for so many of these small businesses being carried on, and as their operations are outside the field of the large works, their existence is not endangered by competition with them. In some cases they are even useful to works on a greater scale, as they provide necessary articles, the consumption of which is so small that it is not worth while a large firm taking up their manufacture. A case in point is that of decolorising carbon, a well-known brand of which, along with other similar products, is made in a factory of the size of a small private house.

From all that has been said, it will appear that competition with Germany in all branches of chemical manufacture is likely to be even more severe than it has been in the past, and although I have carefully and designedly avoided the temptation to point morals, they are plainly contained in the facts I have placed before you.

I make no assertion that these facts are the sole causes of the growth and success of Germany in her particular branches of chemical industry; but they have certainly contributed most largely to it. I do not advocate a slavish copying of their methods, but profit lies in a knowledge and appreciation of them, and the application of the good that is in them, modified to suit our own needs, will surely be to the benefit of the industry.

THE BRITISH SCIENCE AND KEY INDUSTRIES EXHIBITION, GLASGOW.

An exhibition illustrating the progress that has been made within the last few years in the application of science to industry and in the home manufacture of products for which we were formerly dependent on other countries, and especially on Germany, was opened in Glasgow on November 17 by Sir Charles Parsons, to whose inventions the industries of the Clyde owe so much. Whilst on similar lines to the exhibition promoted in London by the British Science Guild, and containing many of the same exhibits, the present enterprise has some new features. It is promoted by the Corporation of Glasgow, which possesses a hall designed for the purpose of technical exhibitions, and provided with ample power and facilities for practical demonstrations. A local committee of scientific and technical men assisted in securing and selecting suitable exhibits, and this committee has been most heartily supported by the Corporation and its staff of organisers. Arrangements have been made for visits by parties of students, apprentices, and junior technical assistants, the educational value of such a collection of exhibits being very great.

Whilst certain sections, notably those of optical instruments and photography, are less representative than in the London exhibition, the display of engineering and shipbuilding work, as is appropriate in the Clyde area, is very complete. Perhaps one of the best object lessons in the application of science to industry is furnished by the exhibit of Messrs. Barr and Stroud, Glasgow, who show range finders, submarine periscopes, the optophone, kinematographs, and other instruments, displaying marvellous accuracy in gear cutting, optical work, scale engraving, and calculating gears. The same firm manufactures its own optical glass, showing a range of products comparable with the best German glass. In chemical glassware, also, the exhibits of the British Chemical Ware Manufacturers' Association and of the Department of Glass Technology of the University prove that the British products have reached the standard of the wares formerly imported. Dyes, fine chemicals, and drugs are well represented, as are the metallic alloys and alumino-thermic metals, the production of which was begun as a war measure. The latest progress in wireless telegraphy and telephony is illustrated by a large exhibit of the thermionic valve, a most efficient transmitting and receiving device, based on the emission of electrons by a heated metallic filament. The great steel firms have large metallurgical exhibits, and Messrs. Beardmore show, in addition, the recent development of aircraft, both in airships and in large aeroplanes, the complete machinery of one of the latter being shown, whilst Messrs. Howden exhibit a flying boat.

A striking feature is the large number of systems of high temperature welding shown in operation, especially those making use of the electric arc. Arc welding has developed rapidly in the last year or two, and is now finding application in all kinds of constructional work in steel. Some of its applications should be of especial interest to chemical manufacturers. Fuel questions are illustrated by maps and specimens showing the efforts to utilise more economically the national resources in coal and oil, as well as by coal-cutting machinery and by a full-size model of a coal seam in course of working by machinery. The Health Department of the Corporation has a large bacteriological exhibit, and kinematograph films of living pathogenic organisms are being shown. Full use is being made of the kinematograph for the purpose of illustrating exhibits of technical interest. The exhibition will remain open until December 6.

THE USE OF STATISTICAL WORK IN CHEMICAL INDUSTRY.

A Report on the Statistical Work of the Factories Branch has now been issued by the Department of Explosives Supply, Ministry of Munitions, which forms a valuable supplement to the Reports on Costs and Efficiencies for H.M. Factories, a review of which appeared recently in this Journal under the heading of Cost Analysis in Chemical Manufacture (J., 1919, 179 R, 224 R).

The present Report might well be used as a handbook by anyone desirous of adopting an adequate system of recording plant efficiencies and of putting into practice a sound method of cost analysis. In it is described clearly and minutely a system of technical records, the immediate effect of which was to facilitate the control of plant working and the introduction of a most interesting method of cost analysis which depended on these technical records. Further, the Report deals not only with methods of finding the actual cost of the finished product, but also with the cost on a comparative basis. The information supplied is completed by reproductions of specimens of technical records sent in by factories, summaries of such records compiled at headquarters, costs sent in by factories, comparative cost sheets drawn up from these at headquarters, and flow-sheets showing the efficiencies of plants and the consumption of materials involved in the manufacture of explosives, such as nitroglycerin, nitrocellulose, TNT, cordite and picric acid. These reproductions, together with the explanations given of them in the text, illustrate clearly the methods employed.

The Report is divided into the following sections: —

I. *The materials manufactured by the factories, and a general account of the processes involved.*—This serves as an introduction to what follows. It is shown that the manufacture of any explosive may be roughly outlined in the following stages: —

1. Manufacture of nitric acid;
2. Preparation of a suitable mixture of nitric and sulphuric acids;
3. Nitration;
4. Subsequent treatment of the nitrated material to obtain the finished explosive;
5. Treatment of the waste acid from nitration for the recovery of the sulphuric acid and of such nitric acid as it may contain;

and that, in addition to these stages, the manufacture of an explosive or explosives at any factory may involve: —

6. The manufacture of sulphuric acid or oleum;
7. The preparation or purification of the substances to be nitrated;
8. The manufacture, purification, or recovery of various solvents required in the final preparation of the explosive from the nitrated body.

II. *The technical aspect of acids manufacture and treatment, and the technical records concerned therewith.*—This deals with the manufacture of nitric acid and sulphur trioxide, the preparation of suitable mixtures of nitric and sulphuric acids, and the treatment of waste acid.

Records are shown from H.M. Factory, Pembrey, for nitric acid retorts, denitration stills, denitration towers, oleum manufacture (Tentelew process), concentration (Kessler), and acid mixing, together with various acid stock accounts.

III. *The actual cost records dealing with acids manufacture and recovery.*—The entire secret of successful cost analysis depends upon dividing each manufacture into a number of separate processes and showing clearly the efficiencies and costs of each. Typical sheets are shown giving the costs of nitric acid manufacture, waste acid denitration, sulphuric acid concentration, etc., at H.M. Factory, Craigleith, and an explanation is given of the headings of expenditure which appear on these sheets. The section closes with an interesting discussion on acid values, *i.e.*, the values to be assigned to strong and weak sulphuric acid and nitric acid, and the fairest method of sharing out the expenses involved in the treatment of spent acid.

IV. *Comparative costs of acid manufacture and recovery.*—In the comparative costs made up by the Factories Branch the aim was to place all the factories as far as possible on a comparative basis, in order to demonstrate to the factory officials their costs of production estimated on the same basis as the costs of others engaged in similar work. For this purpose all raw materials were charged to factories at a uniform flat rate, and allowance was made for factors which operated favourably or otherwise against a factory.

A number of comparative cost sheets is shown giving summaries of total cost and of cost per ton. From the latter graphs showing comparative costs were made, as given in the former reports on costs and efficiencies. In order to demonstrate the numerous service charges most simply in a graphical manner, the headings of expenditure are grouped under wages, fuel, water, steam, and power, maintenance, and general expenses.

V. *Nitration and subsequent treatment of the nitrated material to obtain the finished explosive.*—Technical records and summaries of such records are shown dealing with the nitration of glycerin for nitroglycerin and of cellulose for nitrocellulose, and with the manufacture of cordite, TNT, tetryl, synthetic phenol, and picric acid. A short description is given of each of the processes involved, which serves as an explanation of the data given in the technical records.

VI. *Actual cost of the finished products.*—No difficulties occur regarding the raw materials used and the ordinary service charges, but the question arises as to how the mixed acid used and the spent acid recovered are to be charged against and credited to the product. This matter is discussed, and also the procedure which should be adopted in the case of products such as nitrocellulose and cordite involving considerable labour and other services in the finishing stages.

VII. *Flow-sheets showing the efficiencies of plants and the consumption of materials involved in these manufactures.*—This section is one of the most interesting. In order to summarise clearly and concisely the operations involved in the manufacture of an explosive, and at the same time to provide means for determining accurately and uniformly the consumptions of raw materials in such a way that these may be compared at a glance for various processes employed to obtain the same final product, standardised flow-sheets were introduced in all the big explosive factories. These flow-sheets represent the records of all the acid plants involved in the manufacture of the explosive, quantities of mixed acids used and of waste acids produced, important materials, *e.g.*, sodium nitrate, nitric acid and sulphuric acid consumed per ton of finished product, as well as the quantities of acid to be handled at the various plants. They not only show at once where losses of materials are taking place and the effect of such losses on the total consumption figures, but also, by allowing of comparison between different methods, indicate directions in which modifications might prove advantageous.

A number of flow-sheets are shown for picric acid, TNT, nitroglycerin, nitrocellulose, cordite, and tetryl, with accompanying explanations.

We reproduce here as an illustration one of the simpest, *i.e.*, a picric acid flow-sheet for H.M. Factory, Greetland (page 73 of Report). A thorough explanation of the principles involved in its preparation is given in the text.

H.M. Factory, Greetland.

PICRIC ACID FLOW-SHEET.

From September, 1917, to November 30, 1918.

All figures in tons of 2,240 lb.

1.	2.	3.	4.	5.	6.	7.	8.	9.
Picric Acid made.	Phenol consumed.	Sulphuric Acid for sulphonation.	Nitric Acid for nitration.	Waste Acid produced.	Nitric Acid consumed as HNO_3	Nitrate of Soda consumed.	Sulphuric Acid consumed as H_2SO_4.	Sulphuric Acid Concentration.
2025·075	1412·856	6061·359 tons H_2SO_4	3755·84 tons HNO_3	5422·81 tons H_2SO_4	3533·964	Nitrate of Soda 5362·826 $NaNO_3$ .. 5015·967	5882·942	To be concentr'd 5314·48 To be delivered .. 5021·121
		R.O.V. in sulphonate used. Acid. / % / H_2SO_4 6410·361 / 95·0 / 6061·359	Acid. / % / HNO_3. 5768·43 / 65·1 / 3755·84	Acid. / % / H_2SO_4. 11811·43 / 45·9 / 5422·81	Used for Nitration 3755·84 *Less* Recovery at Fume Towers .. 221·876 3533·964	Retorts working HNO_3 produced 3815·0 Nitrate of Soda 5780·33 (Gross overall.) $NaNO_3$ .. 5414·88 (Retorts usage.) H_2SO_4 .. .. 5108·00 1 ton requires: Nitrate of Soda 1·518 $NaNO_3$ .. .. 1·419 H_2SO_4 .. .. 1·355 Retorts efficiency 95·1% 3533·964 tons require: Nitrate of Soda 5362·826 $NaNO_3$ .. 5015·967 H_2SO_4 .. .. 4787·284	At retorts .. 4787·284 Loss on plant: H_2SO_4 in sulphonate used 6061·359 H_2SO_4 in waste acid .. .. 5422·81 Loss .. .. 668·540 *Loss in concentration.* A. Before final concentration 108·33 B. In concentration .. 203·359 (5·52% of 5314·48). C. R.O.V. plant 25·42 5882·942	Concentrators working over period. Charged: Acid. / % / H_2SO_4. 8617·01 / 66·2 / 5701·2 Recovered: Acid. / % / H_2SO_4. 6430·30 / 83·8 / 5386·54 Loss .. .. 314·66 Loss % .. .. 5·52 R.O.V. Plant. Charged: Acid. / % / H_2SO_4. 601·39 / 84·1 / 505·9 Recovered: Acid. / % / H_2SO_4. 504·99 / 95·2 / 480·48 Loss .. .. 25·42 Loss % .. .. 5·02
Required to produce 1 ton picric acid.	0·538 Yield on phenol consumed, 185·8%	R.O.V. used. % H_2SO_4 95·0 2·32 H_2O .. 5·0 0·122 100·0 2·442	% HNO_3 65·1 1·431 H_2O .. 34·9 0·766 100·0 2·197	% H_2SO_4 45·9 2·066 H_2O .. 54·1 2·433 100·0 4·499	Used .. .. 1·431 Recovered .. 0·085 1·346	Nitrate of Soda (Overall crude figure, including loss in handling.) 2·042 100% $NaNO_3$ .. (Retorts usage.) 1·011	Retorts .. 1·824 Nitration loss .. 0·255 Concentration: A. .. .. 0·041 B. .. .. 0·112 C. .. .. 0·010 2·242	Waste acid to be concentrated H_2SO_4 .. .. 2·025 To be delivered from concentrators, H_2SO_4 1·013
Period—Five weeks ending Nov. 2, 1918. 1 ton picric acid required.	0·528 Yield on phenol consumed, 180·3%	R.O.V. used. % H_2SO_4 95·0 2·255 H_2O .. 5·0 0·119 100·0 2·374	% HNO_3 64·4 1·380 H_2O .. 35·6 0·762 100·0 2·142	% H_2SO_4 47·9 2·022 H_2O .. 52·1 2·200 100·0 4·222	Used .. .. 1·380 Recovered .. 0·120 1·260	Nitrate of Soda (Overall crude figure, including loss in handling.) 1·883 100% $NaNO_3$ .. 1·758	Retorts .. 1·691 Nitration loss .. 0·233 Concentration: A. .. .. 0·036 B. .. .. 0·081 C. .. .. 0·013 2·054	Waste acid to be concentrated H_2SO_4 .. .. 1·985 To be delivered from concentrators, H_2SO_4 1·904
Period—Five weeks ending Sept. 28, 1918. 1 ton picric acid required.	0·536 Yield on phenol consumed, 186·7%	R.O.V. used. % H_2SO_4 95·0 2·265 H_2O .. 5·0 0·119 100·0 2·384	% HNO_3 64·5 1·396 H_2O .. 35·5 0·770 100·0 2·169	% H_2SO_4 46·0 2·078 H_2O .. 54·0 2·440 100·0 4·518	Used .. 1·399 Recovered .. 0·119 1·280	Nitrate of Soda (Overall crude figure, including loss in handling.) 1·914 100% $NaNO_3$ .. 1·791	Retorts .. 1·712 Nitration loss .. 0·187 Concentration: A. .. .. 0·042 B. .. .. 0·088 C. .. .. 0·019 2·048	Waste acid to be concentrated H_2SO_4 .. .. 2·036 To be delivered from concentrators, H_2SO_4 1·049

VIII. *Comparative cost of the finished products.*—The question of comparative costs is fairly simple when once the methods of finding actual costs and of constructing flow-sheets have been established.

The items included in the comparative cost of any of the finished products dealt with can be grouped in three sections. One section deals with the service charges, another with the raw materials, and the last refers to the acid usages, the method of showing which is very different from that adopted in the actual costs. When a flow-sheet is available the acid usages can be found at once. As flow-sheets were not always accessible, the method of finding the acid usages on exactly the same lines was developed by means of what are called "Voucher" sheets, examples of which are given, together with an explanation of the headings and instructions appearing on them.

Summaries of total cost and of cost per ton on a comparative basis are given for nitrocellulose, nitroglycerin and cordite.

Following these comparative costs, constructed on what is termed the "normal" basis, some "ultimate comparative costs" appear. In these, in place of the HNO_3 and H_2SO_4 usages, the raw materials, sodium nitrate and sulphuric acid and oleum, expressed as SO_3 or H_2SO_4 appear, and consequently the service charges include not only acid mixing, nitration and finishing, but also the service charges involved in the manufacture of the nitric acid consumed and in the denitration and concentration of the waste acids to be handled. The total cost, of course, is the same, though the method of arriving at it is varied.

Nitroglycerin, nitrocellulose and cordite ultimate costs are shown.

This section closes the Report, but two appendices are added, the first being a reproduction of a complete set of technical records received from H.M. Factory, Queen's Ferry, for the month ending December 29, 1917, and the second being a reproduction of the cost accounts of H.M. Factory, Gretna, for the period (four weeks) ending June 29, 1918.

The earlier Reports on Costs and Efficiencies showed the great improvements that could be effected in chemical manufacture by the help of cost analysis. The present Report on the Statistical Work of the Factories Branch shows each step of the way in the acquirement of the requisite statistics. The advantage of analysing costs so that the cause of a high cost of manufacture cannot be hidden is manifest. To those who study this report the way to arrive at such an analysis is made clear.

A FURTHER NOTE ON "MUSTARD GAS."

SIR WILLIAM POPE.

Only two chemical points are raised in Dr. Green's recent note (this J., 1919, 363 R) on the history of "mustard gas" and these can be settled decisively in the light of our present knowledge.

1. In Guthrie's study of the action of ethylene on sulphur monochloride (J. Chem. Soc., 1861, 13, 134), the gas was left in contact with the sulphur chloride for 20 hours at 100° C.; the resulting product was shaken with warm water, dried, digested with ether, filtered, evaporated in vacuo, dissolved again in ether, filtered and evaporated in vacuo. The product then gave analytical results corresponding to the composition $(C_2H_4Cl)_2S_2$, and it is stated that "a drop placed beneath the tongue destroys the epidermis and causes a soreness which lasts many days."

Experiment has shown that no $\beta\beta$-dichlorethyl sulphide results from the action of sulphur monochloride on ethylene at temperatures much higher than 60° and that $\beta\beta$-dichlorethyl sulphide or Messrs. Levinstein's product is immediately acted upon by sulphur monochloride at temperatures higher than 60 or 70° C. with production of other chlorinated ethyl sulphides. These latter substances are irritant to an extent which is small in comparison with the activity of mustard gas and which is of the order mentioned by Guthrie. Had a drop of mustard gas been placed under the tongue the patient would certainly have died.

These facts formally disprove Dr. Green's conclusion that Guthrie obtained mustard gas from ethylene and sulphur monochloride; they substantiate my statement (this J., 1919, 344 R) that the method devised by Gibson and myself "was entirely novel; no suggestion had been previously made that any such process was possible."

2. On treating the product obtained by acting on sulphur monochloride with ethlylene at 30° C., and which I have spoken of as a "pseudo-solution" of sulphur in the monosulphide $(CH_2ClCH_2)_2S$, with an organic diluent such as alcohol or ether, the sulphur separates, leaving a solution of $\beta\beta$-dichlorethyl sulphide. This fact conclusively refutes Dr. Green's suggestion that the Levinstein product is a disulphide.

In addition to Dr. Green's two chemical fallacies, which I have exposed above, he is haunted by another, which I had thought was dispelled by my previous note. Dr. Green credits me with being the inventor of a process, the which, having stated, he proceeds to demolish. I never produced any process; my efforts were limited to discovering, in collaboration with Mr. C. S. Gibson, a method for preparing mustard gas which Messrs. Levinstein duly converted into a works process. Dr. Green's failure to appreciate the situation is in part due to his misapprehension of the chemical aspects of the mustard gas reaction; the following facts, stated chronologically, may clear up the misunderstanding.

At the end of January, 1918, Mr. Gibson and I, as "scientific advisers," gave the authorities full laboratory details of an entirely new and quantitative method of making $\beta\beta$-dichlorethyl sulphide by the action of ethylene on sulphur monochloride. In a document handed in on January 28, 1918, and which is on the official records, we state that "the interaction is conveniently carried out by passing a current of dry ethylene gas through sulphur monochloride, S_2Cl_2, either in the cold or warmed. When the reaction ceases, a mixture of sulphur with the $\beta\beta$-dichlorethyl sulphide or a solution of sulphur in $\beta\beta$-dichlorethyl sulphide is obtained." Other particulars concerning the rapidity of absorption at different temperatures and the activity of a catalyst are added. In face of this record no one will credit Dr. Green's statement that three months later he had difficulty in convincing either of us that mustard gas can be produced by acting upon sulphur monochloride with ethylene at 30° or that I was sceptical as to the potency of Messrs. Levinstein's product. Further, since we knew that no disulphide is produced, although Dr. Green thinks it is, his statement that scientific advisers attached to the Government "maintained that the separation of sulphur was an essential part of the process, without which an inactive disulphide would result," is absurd.

Early in February, 1918, the technical chemical advisers to the Government commenced converting our laboratory method into a works process. The scientific advisers were not consulted as to which chemical manufacturers should be asked to collaborate in this work.

On April 19, 1918, Dr. Green informed me that he had interested himself in the manufacture of mustard gas and on the same day I introduced him to the technical authorities dealing with the matter. They did everything possible to forward

Messrs. Levinstein's plans for installing the process and that these efforts were successful is evident from the fact that Messrs. Levinstein had a plant producing early in June, 1918.

Dr. Green gives the text of a telegram sent him on May 11, 1918, which shows that some misunderstanding had arisen; he does not name the signatory, but indicates clearly that the sender was Lord Moulton's chief technical adviser, a very eminent chemical engineer. No scientific adviser was involved in any differences which may have arisen between the two, apparently antagonistic, groups of technical experts.

It will be remembered that I entered upon the present discussion in order to correct the ridiculous assertion that "scientific advisers" prevented the effective development of a mustard gas programme. I claim to have shown that the programme was from the beginning entirely in the hands of technical men—chemical manufacturers and chemical engineers—and that the "scientific advisers" confined themselves to the discovery of a novel reaction which obviously lent itself well to the development of a works process.

NEWS FROM THE SECTIONS.

MANCHESTER.

At the meeting held on November 7, Mr. J. Allan in the chair, a paper on "The Estimation of p-Phenylene Diamine," by Drs. T. Callan and J. A. R. Henderson was read by the former.

Para-phenylene diamine can be accurately and rapidly determined by adding a solution containing it to an excess of a standardised solution of sodium hypochlorite, and titrating back with decinormal sodium arsenite in presence of starch-iodide paper, the available chlorine present being removed by the base as insoluble benzo-quinone dichloro-imide. Naphthalene 1:4 diamine, and p-amido diphenylamine can also be estimated by this method, which, however, fails when a sulphonic group is present in the molecule, owing to the formation of soluble chloro-imides.

The second paper on "The Estimation of Sulphuric Acid in the presence of Organic Sulphonic Acids" was by the same two authors in collaboration with Mr. R. Barton. The presence of organic sulphonic acids might conceivably affect the determination of sulphuric acid owing either to the solubility of barium sulphate in solutions of sulphonic acids or to the precipitated barium sulphate containing admixed barium sulphonate. A number of sulphonic acids of the benzene and naphthalene series containing known amounts of sulphuric acid were analysed, with the result that neither of these possible disturbing influences was found to be operative. A rapid method for the volumetric estimation of sulphuric acid was also described. An excess of N/4 barium chloride is added to the neutralised acid and, after boiling, the excess is found by titrating with N/4 potassium chromate, the end point being ascertained with starch-iodide paper very faintly acidulated with hydrochloric acid.

An electrical distance thermometer was exhibited by the Cambridge Scientific Instrument Company.

BRISTOL AND SOUTH WALES.

A meeting of this section was held at the University College, Cardiff, on November 7. Mr. W. R. Bird who presided, announced that an invitation had been received from the South Wales Institute of Engineers to a special meeting on November 27, to hear a paper from Mr. S. R. Illingworth, on the "Chemistry of Coal."

Mr. F. J. Popham, in a paper on "Peat," outlined the various processes which have been applied on a commercial scale for the production of a good fuel from peat bogs in various parts of the world. The commercial success of the "wet carbonising" or any other process depends on the "heat balance," that is, it must be self-contained, the peat providing its own fuel for the process, and this must absorb less than the total heat units in the dry product. In an efficient plant there would be a margin of 25 per cent. Owing mainly to engineering difficulties, complete success has not yet been obtained.

The meeting at Bristol on November 13, at which Mr. E. Walls presided, was devoted to Chemical Engineering, with particular reference to "Sulphur and Sulphur Burners." Mr. C. A. Hawkes introduced the latter subject, and described the manifold difficulties attending the combustion of sulphur in its various forms and combinations. The discussion was contributed to by Prof. J. W. Hinchley, Mr. H. B. P. Humphries, and Mr. H. Talbot, who attended from London as representatives of the Chemical Engineering Group.

Prof. Hinchley referred to the backward state of this country in regard to chemical engineering, and to the circumstance that we had to rely on American assistance during the war. The type of man required was not in every case a first class engineer, but one who combined sufficient knowledge of both subjects to interpret engineering problems to the chemist and chemical problems to the engineer.

Mr. Talbot outlined the programme and policy of the Chemical Engineering Group, and Dr. Francis spoke interrogatively on the requisite training for a chemical engineer, which to be adequate, would apparently have to cover an unusually extended period.

BIRMINGHAM.

On November 13, at the University Buildings, Mr. L. P. Wilson presided over a well-attended meeting, which included a large number of members of the Birmingham Metallurgical Society. Mr. C. J. Brockbank, of Thorold, Ontario, read a paper on the "Production of Artificial Abrasives in the Electric Furnace." Artificial abrasives require for their production large quantities of electrical power such as can be cheaply obtained from the enormous water power resources of Canada and the United States. In Canada several large plants are devoted entirely to the production of the two kinds of artificial abrasives, carborundum and aluminous abrasives or artificial corundum. These products are known by various trade names, and upwards of 140,000,000 lb. was produced last year.

Silicon carbide is made from petroleum coke and the purest white sand. Precautions are taken to allow free exit for the large volume of carbon monoxide evolved, and to remove impurities. The crushed mass is treated with acid and alkali to remove surface impurities which would spoil the porcelain bond used in making up into grinding wheels. Artificial corundum is made by smelting a mixture of bauxite and coke in an arc furnace, and is obtained as a large pig or ingot. The impurities, silicon, iron and titanium, are found as an alloy in the bottom layer of the ingot, but the presence of one or two per cent. in the corundum increases its toughness.

Silicon carbide is intensely hard and very brittle. It is suitable for grinding brittle materials such as cast iron and marble and is used in the dressing of leather; but it is quite unsuitable for producing the smooth finish required in grinding steel, and for this and similar purposes artificial corundum is employed. These artificial abrasives have entirely superseded natural emery except for a few operations, such as glass polishing.

LIVERPOOL.

The opening meeting of the session was held in the Adelphi Hotel, Liverpool, on November 17. The principal item was the delivery by the new chairman, Dr. E. F. Armstrong, of an address entitled "The Outlook for British Chemical Industry," which was the subject of appreciative remarks by Mr. John Gray, Mr. A. T. Smith, Mr. A. Carey, and others. The address will be inserted in the next issue of the "Review."

MEETINGS OF OTHER SOCIETIES.

INSTITUTION OF PETROLEUM TECHNOLOGISTS.

The meeting held on November 18 was devoted to a paper on "The Conservation of Oil," by Rear-Admiral Philip Dumas.

The author, as chief secretary of the Royal Commission on Oil Fuel Engines, has come to the very definite conclusion that waste was the key-note of the mineral oil industry, and he made it the key-note of his lecture. His inquiries had convinced him that wasteful search, wasteful boring, wasteful production, wasteful storage, wasteful use of main and by-products, wasteful transport, wasteful retail sale, waste in the lack of concentrated chemical research into its chemical constituents, and waste in its economic use, combined with a waste of brains with regard to improvements in the industry, were the order of the day, and he wondered why a luxury such as oil should have been given to the people of the world to play ducks and drakes with. He was of the opinion that the large corporations which to-day make huge profits out of oil should endow more universities and provide greater facilities for the training of young brains in the science and technology of mineral oil, so that these might eventually be in a position to help conserve this great source of power. The advantages and disadvantages of oil fuel were described minutely, and the view expressed that the navies of the world are to-day the greatest oil wasters. In times of peace the capital ships of the Navy should use coal, so that the industrial efficiency of merchant shipping might be increased by the more general use of oil fuel. There was vast room for improvement in the economic development of the internal combustion engine, and the time was not far distant when oil fuel, instead of being used under boilers, would be used in improved types of internal combustion engines, which would become the motive force of the ships of the future.

Sir Marcus Samuel, in proposing the vote of thanks to the lecturer, stated that the world's supply of oil was sufficient for many years to come. The English internal combustion engine for commercial purposes had been introduced in several of his company's ships during the war, and had proved their commercial possibilities. Admiral Goodwin, who followed, considered that the internal combustion engine for high power ships was not an economic possibility in the near future. Sir Charles Greenway also supported Sir Marcus Samuel's opinion that the future production of oil was absolutely assured. The supply depended purely on the economic demand, and, if necessary, the output could be doubled within the next ten years. Sir John Cadman remarked that, in spite of criticism, the technology of oil was better understood than the technology of coal, while Mr. Gordon Craig supported the lecturer in his remarks regarding the lack of opportunity for real education in the oil industry, and the need for the clarion call that the oil supplies of the world should be conserved.

TECHNICAL INSPECTION ASSOCIATION.

An address on "The Spectroscope in the Science of To-day" was given by Prof. E. C. C. Baly in London on November 7.

The lecturer pointed out that the complete spectrum is many hundred times longer than that portion of it detectable by the eye; it comprises wave lengths ranging from 0·3 mm. and 0·0001 mm., and the visible portion consists of wave-lengths between 0·00076 mm. and 0·00039 mm. The growth of spectroscopic discovery was briefly reviewed and illustrated by the discovery of the elements rubidium, caesium, gallium, thallium, indium, and the rare gases of the atmosphere. The process of separation of the rare earths is materially assisted by a study of their phosphorescent spectra, developed by cathodic bombardment in vacuo, these affording an invaluable guide to the progress of the separation. A chemically pure substance exhibits no phosphorescence whatever. By utilising the fact that when an element is present in a mixture to only a very small extent, only very few of its characteristic lines are developed in the spectrum, quantitative determinations by means of the spectroscope are possible. The application of absorption spectra to quantitative determination was instanced by Robertson's work on the stability of nitro-cotton and nitro-glycerin when heated. The method might similarly be applied to the inspection of TNT and ammonium nitrate.

The applications of the spectroscope to astronomy were briefly described, special reference being made to the spectra of the stars and nebulæ. There is evidence that stars arise from a process of nebular condensation. The spectra of the youngest stars and the original nebulæ exhibit the lines of hydrogen and helium together with the lines attributed to a hypothetical element, nebulium, hitherto undiscovered on the earth. With increasing age of the stars, the spectral lines characteristic of increasingly heavier elements make their appearance, and the conclusion seems inevitable that all the elements arise by some process of condensation from hydrogen and helium, on the lines originally suggested by Prout in 1815, and supported by the recently discovered phenomena of radio-activity. Further support of the theory is afforded by the existence of what Lockyer has called "enhanced lines" in the spectra of certain stars. Within recent years it has been established that the wave-lengths of the energy absorbed and radiated in any chemical reaction are absolutely characteristic of the substances partaking in it.

In the course of the lecture, Professor Baly entered a plea that a course in up-to-date spectroscopy should form part of the training of every student of chemistry.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

At the opening meeting of the newly-formed chemical section, Sir William J. Pope gave an address on "The Photography of Coloured Objects."

The discussions which took place some twenty years ago on the value of photography as a means of artistic expression in reality centred around the insensitiveness of the ordinary photographic plate to rays of low refrangibility; for representation of parti-coloured objects the plate must be sensitive to red and yellow rays. By staining the ordinary blue-sensitive plate with erythrosine, it becomes sensitive to green and orange, and with the aid of certain cyanine dyes a plate may be sensitised throughout the entire range of the visible spectrum. At the outbreak of war the Allies were entirely dependent on Germany for these sensitising dyes, which are essential in aerial photography. The slight haze which tends to

obscure a distant scene to the naked eye is enormously intensified on an ordinary plate, blue light penetrating a clear atmosphere much less readily than red and yellow. Hence a photograph taken in red light only would give much greater detail. The production on a technical scale of the requisite sensitisers was achieved in the Cambridge laboratories, and at the date of the armistice 80 per cent. of the plates employed in the British photographic air-service was red-sensitive or panchromatic. The best panchromatic plate made before the war possessed about one-third the sensitiveness to red as to blue light, but at the present time a plate much faster to red than to blue light is on the market; thus the rapidity to red light has been increased about four-fold

The chief processes at present available for the photographic reproduction of the colours of particoloured objects were explained and examples of each exhibited.

THE CHEMICAL SOCIETY.

The new session was opened on November 6 with an ordinary scientific meeting, at which the President, Sir J. J. Dobbie, presided. Mr. W. E. Garner read a paper by Prof. F. G. Donnan and himself on "Equilibria across a Copper Ferrocyanide Membrane and an Amyl Alcohol Membrane." The equilibria established across semipermeable membranes are in agreement with Donnan's theory (Z. Elektrochem., 1911, 17, 572) in the case of the copper ferrocyanide and the amyl alcohol membranes. Solutions of potassium and sodium ferrocyanides are in equilibrium across a copper ferrocyanide membrane when the ratio of the potassium to the sodium concentrations is the same on the two sides of the membrane. Solutions of sodium and calcium ferrocyanides are in equilibrium when the ratio of the square of the total sodium concentration to the total calcium concentration is the same on the two sides of the membrane. The results of measurements of the equilibria of lithium and chlorine ions on the two sides of the amyl alcohol membrane also confirmed the theory.

In a paper on "Peroxides of Bismuth," by Mr. R. R. Le G. Worsley and Dr. P. W. Robertson, the latter described the products obtained by the oxidation of bismuth salts by chlorine in an alkaline solution. The product obtained when dilute alkali is used is a mixture of oxides and hydrated oxides which can be separated by the action of nitric acid of various concentrations.

Dr. T. M. Lowry and Mr. R. G. Early contributed a paper on "The Properties of Ammonium Nitrate, Part I., the Freezing Point and Transition Temperatures." The freezing point, which can only be determined with accuracy when the material is ground before drying, is 169_{D} C. On cooling the fused nitrate, distinct arrest points were observed at 125°, 84°, and 32° C.

The final paper was by Messrs. R. R. Baxter and R. G. Fargher on "Some 1:3 Benzodiazolearsinic Acids and their Reduction Products."

At the informal meeting held on November 20 Mr. J. E. Purvis, of Cambridge University, exhibited a series of photographic reproductions of the spectra of some organic compounds.

A New Petrol Substitute involving the use of alcohol is finding such favour in the United States that the manufacturers propose to erect a new plant to increase production. The fuel costs more than petrol, but is said to give an increased mileage, which compensates for the added cost. A much more important advantage is the cleanliness of the fuel, absence of carbon deposits on spark plugs and in cylinders, and greater safety.

NEWS AND NOTES.

CANADA.

Copper in Manitoba.—The Flin Flon property containing enormous quantities of fair-grade copper ore and much smaller quantities of very rich copper, gold and silver ores, has been sold to a development syndicate. It is hoped to run a railway within 70 miles of Le Pas, and that a large copper smelting industry will grow up within a few years.

Soda Ash Production.—After considerable delay, the new plant of the Brunner, Mond Company of Canada, at Amherstburg, Ont., has started operations. The daily output is stated to be 50 tons, compared with a capacity of 125 tons. The undertaking is entirely self-contained, power plants, salt wells and limestone all being situated on the property.

A Pitchblende Discovery.—The Ontario Government has explored the discovery of pitchblende near Kearney, in the Muskoka district of Ontario. It occurs in a coarse granite pegmatite dyke, some four feet in width, consisting of red and white felspar, white quartz, white and black mica and pitchblende. The last appears to be associated with the red felspar, and is thus similar to the only other occurence known in Canada. Euxinite, giving indications of radium, has been found in Lanark County. The mineral itself contains 63·60 per cent. of uranium, and the felspar with which it is associated, 0·35 per cent. The pitchblende carries 10 per cent. of lead. Since 1914 the province of Ontario has offered a reward of $25,000 to the first discoverer of ores containing radium suitable for commercial extraction.

SOUTH AFRICA.

Manganese Ore in the Transvaal.—At various times, and notably during the war, search has been made for commercially valuable manganese ores in the Transvaal. The neighbourhood of Krugersdorp, among others, has long been known as a manganiferous area, and recently a payable deposit of pyrolusite was discovered there. A company capitalised at £50,000 has been formed to purchase and develop the property.

Exploitation of the Nitrate Deposits at Prieska.—The South African Nitrate and Potash Corporation, Ltd., Johannesburg, which has a capital of £160,000 with power to increase to £500,000, is about to work the shale deposits in the districts of Prieska and Hay, which contain from 3 to 10 per cent. of potassium nitrate, and were described recently in this Journal (1919, 360 T). The Corporation has acquired the rights over some 300 sq. miles of the deposits and intends to work the shales themselves and not the débris, as was formerly attempted. They are to be worked, at least at first, from existing cliff faces and as far back as the shales are oxidised and contain nitrates. The latest view as to the origin of the nitrates is that they have been formed by the action of bacteria, or possibly of electricity, the potash or other base having previously existed in the shales in some other form of combination. The shales are to be broken out by quarrying, passed through a ½-inch screen, and the other portion, which has a high proportion of nitrate, is to be used directly as a fertilising agent. The coarser portion is to be leached with hot water and the solution concentrated and the nitrate recovered by crystallisation. The final mother liquors are either to be used as a fertiliser or as a source of nitric acid. In former years the working of these deposits was hampered by scarcity of water, but an ample supply is stated to be obtainable by boring at a depth of from 50 to 100 feet. At a later date it is proposed to manufacture sulphuric acid from a deposit of pyrites

belonging to the Corporation and to establish nitric acid, fertiliser, and explosive works in the vicinity of a central depôt to be situated at Prieska. This place is convenient to the deposits, and is only 112 miles from De Aar Junction, itself 339 miles from Port Elizabeth.—(*U.S. Com. Rep., Sept.* 30, 1919.)

BRITISH INDIA.

Industries in Bombay.—The Annual Report of the Director of Industries of the Bombay Presidency for 1917—1918, recently to hand, gives a brief *résumé* of the work accomplished by the Department under the war conditions then prevailing, with short notes on some aspects of the chief industries examined.

Handloom Weaving.—This industry has been generally greatly hampered by the high price of yarns, the uncertainty of the market, and the difficulty of obtaining dyes.

Pottery.—The manufacture of bricks, and to a smaller extent of roofing tiles, is carried on in various parts of the Presidency. No other branch of the pottery industry has yet been attempted in Bombay, notwithstanding the abundance of raw material; but it is hoped that when the Demonstration Factory, for which proposals are being prepared, is established, the commercial possibilities of various new lines of work will be indicated. The brick industry is flourishing, but the quality of the product leaves much to be desired, although it has been demonstrated that a brick far superior to the ordinary Kalyan brick can be made from local material. The roofing-tile industry requires encouragement and guiding along right lines of manufacture. Capital is being invested in various districts, and considerable progress may be shortly expected.

Oil-seed Crushing.—The production of vegetable oils has increased of late years. The difficulty, however, appears to be that the right type of machinery is lacking. The introduction of more efficient methods of decortication, de-shelling and washing of seeds would result in the production of purer articles and effect a saving in labour. With regard to the utilisation of the oils, methods of purification are necessary, and such oils would then be of value for edible purposes. A great future awaits the Indian vegetable oil trade with the introduction of hydrogenation. The saving in transport alone would be enormous, apart from the production of a wholesome and efficient substitute for "ghee."

Glass.—War conditions, while generally hampering industries, have temporarily assisted others through restrictions on freight, and glass is one of these. Five glass-making firms have started in Bombay city during the war, nnd, in spite of difficulties in regard to coal supply, have met to some extent the local demand, in particular for cheap lamp-ware.

Sugar.—The possibilities of sugar manufacture are to be tested by a local syndicate in the Ahmednagar district, where a suitable area of land on one of the new canals has been acquired. The syndicate's operations are watched with considerable interest and must prove of the greatest value as a lesson in the economical use of water and manure.

Miscellaneous.—Brush-making has made some progress and the class of articles produced has undoubtedly improved. Button-making may command more notice in the future. Raw materials for this industry are available in the shape of bone and horn, in addition to the "hoka" nut, found in the south of Kathiawar, and the tali palm seeds of Kanara. The Department has taken over temporarily certain button-making machinery and proposes to experiment and examine the possibilities.

In the absence of any available expert no experiments in tanning have been made on this side of India. Leather belting is made in Bombay, and its suitability to compete with the imported article is under investigation.

FRANCE.

Industrial Notes.—*Chemical Industry.*—The renewal of trade relations with Germany is the great question of the day, especially in view of the great shortage of dyes and intermediates. The lead taken by Belgium in adopting the policy of the open door as regards enemy products has caused quite a sensation in French industrial circles. Common sense and expediency dictated this policy to Belgium because in many respects she was in the same predicament as France, lacking all the most essential materials vital to her industries, such as carbonate of potash, which is required in great quantities for glass-making. It is anticipated that England and America will follow suit, and France, in spite of a strong moral reticence, will be forced by circumstances to follow the example of her Allies.

Prices are rising everywhere, and even war products, such as acetic acid, show the same tendency. The shortage of coal will not improve matters, and the further call made on production by the devastated provinces as they gradually come back to life will in all probability keep up prices for some time to come.

Coal and Transport.—American coal is finding its way to most of the French ports. Rouen has received American and German coal, and there are large stocks on the quays at Bordeaux and Le Havre. The difficulty lies in distribution, country districts being cut off from the ports. The textile industry is, in particular, severely handicapped by lack of transport facilities, cotton remaining stocked at Le Havre which should be conveyed to the looms in eastern France; more than 3,000 workers have thus been thrown out of employment. The Government is taking strong measures to put an end to the transport crisis and has appointed two committees, one to co-ordinate the activities of the different railway companies, and the other, a technical committee, to look after the efficiency of the rolling stock proper.

The French metal market is much disturbed on account of the shortage of raw materials, and it is feared that many factories will have to close down, instances of this kind having already occurred in the North of France. Firms are being driven to import from England and America, notwithstanding the unfavourable rate of exchange; with normal means of transport their requirements could be easily met from home sources, such as Lorraine.

Petroleum.—Prospecting for oil in Algeria has recently been very active. The "New Grosny Oilfields Co., Ltd.," has struck oil at a depth of 180 metres at Mesilla and Medjilla, in Oran, and the bore-holes at these two places are each producing four tons of oil per day. The success of this English company is rousing the French industrials to a sense of keener interest in the development of the natural riches of their colony as well as of the potential oilfields in the Jura and Les Landes districts of France.

Metallurgy.—The tendency of French metallurgy before the war was to be as self-centred as possible. The ideal which each individual company aimed at was to group together the blast furnaces, steel works, and rolling mills, and to obtain command of raw materials by buying or obtaining concessions for iron and coal mines. Once this concentration had been achieved the next step was to increase and intensify production; and this was done slowly by a judicious distribution of the accumulated profits more than by any sudden increase of capital,

thus leaving the latter relatively small compared with the magnitude and importance of the undertaking.

This state of things is being gradually modified as a result of the war, and the tendency now is for such big self-contained firms as Schneider and Co., La Marine, Micheville, and Pont-à-Mousson to extend their spheres of action and become great banking concerns controlling many factories making finished products, navigation companies, etc. This policy first became manifest when Alsace-Lorraine was returned to the mother-country.

French metallurgists are now ousting the Germans from the splendid factories which the latter built in Lorraine, and many are giving up their former policy of gradually extending their own works to share in the riches and development of the recovered province. The present outlook is consequently one of constant fusion, absorption and amalgamation of various interests, and this is paving the way to a sort of State collectivism; owing, however, to the strongly individualistic temperament of the French, it would not be surprising if a reaction were to ensue. The Germans are fully aware of the great possibilities of French metallurgy, but they entertain the hope that the French character and French capital will be unequal to the task of realising them. Meanwhile, the blast furnaces in Lorraine continue to be severely handicapped by the great shortage of coke, adequate supplies of which are dependent on good transport facilities. As a result of recent strikes, the production of iron ore in Lorraine during September was only 440,000, against 655,000 tons in August; the quantity exported was 500,000 tons, of which 100,000 tons went to Germany.

Supply of Potash to France from Alsace.—The following figures show the deliveries of potash in metric tons from Alsace to France during the first six months of 1919: Kainite (12—16%) 77,055, sylvinite (20—22%) 40,048, potassium chloride (50—60%) 14,428. The total (131,531 metric tons) is equivalent to 27,543 tons of pure potash. In 1913 the total consumption in France was equivalent to a maximum of 35,000 tons.—(*Z. angew. Chem.*, *Oct.* 3, 1919.)

UNITED STATES.

New Mining Research Laboratories at Pittsburgh.—The great Pittsburgh laboratories of the U.S. Bureau of Mines were formally opened at the beginning of October. They have been erected at a cost of a million dollars and are designed for investigations relating to mining, including the study of accidents and methods of preventing them; they will also serve as a bureau where miners and operators may obtain information and help. Chemical and physical research is to be pursued on gases, explosives and mineral substances. The research work done under the direction of the Bureau at various stations and laboratories is divided under the headings Mining, Metallurgy, Petroleum, Mineral Technology, and Mechanical Equipment, under which the utilisation of fuel is included.

Detection of Soya Bean Oil in Linseed Oil.—Research conducted at the Bureau of Standards indicates that a satisfactory hexabromide method for detecting even small percentages of soya bean oil in linseed oil is rapidly nearing perfection. Hitherto the iodine number has been the only constant of use in identifying these two oils, but in mixtures of them as much as 30 per cent. of soya bean oil could escape detection since the iodine number would still fall within the limits allowed for pure linseed oil. The hexabromide method, however, may make it possible to detect as little as 5 per cent. soya bean adulteration. The hexabromide figure for pure linseed oils appears to lie between 45·6 and 46·9, while the upper limit for soya bean is about 5, most samples averaging around 2·2.

Institute of Baking.—Representatives of the 28,000 baking establishments in the United States, after two years of preparatory work, have formed the American Institute of Baking, with ample financial support to carry out its programme. The Institute will conduct research on fundamental problems connected with the industry, will study all matters relating to production, and interest itself in educational affairs. The National Research Council will co-operate in selecting problems, proposing methods of attack, and will act generally in an advisory capacity.

Records of Prices of Chemicals.—The War Industries Board has issued a series of valuable bulletins covering the history of prices of various commodities, which may be purchased from the Superintendent of Documents, Government Printing Office, Washington. The chemical group includes minerals, acids, heavy chemicals, miscellaneous inorganic chemicals, fertilisers, soaps and glycerin, essential oils, flavouring and perfumery materials, wood distillation products and naval stores, natural dyestuffs and tanning chemicals, coal-tar crudes, intermediates and dyes, drugs and pharmaceuticals, explosives, proprietary preparations and miscellaneous organic chemicals.

Chemical Glassware.—As a result of complaints regarding a lack of uniformity in American-made chemical glassware, a committee of the American Chemical Society has undertaken to survey the situation, and, where necessary, devise means of improvement. Imported wares were never perfect in this respect, but less experienced manufacturers have shown an inclination to vary dimensions which, it is feared, will make the re-entry of German material much less difficult. The quality of American glassware is very satisfactory, and there is no reason why necessary corrections in size and shape should not be made promptly.

"Chemical Abstracts."—The final volume of the decennial index of "*Chemical Abstracts*" will be issued shortly, and the editors are to be congratulated on some unique features which greatly assist the reader in searching through the chemical literature for the years covered. The "Ring Index" is an original feature which will enable one to trace any ring complex by its formula without knowing its name. Abundant use is made of cross-references, subjects rather than words are indexed, and page references include figures indicating fractions of a page which are especially useful in organic chemistry. The naming of organic compounds according to a uniform system and indexing them under the names of parent compounds gives the index more of the character of a general hand-book of organic compounds than anything attempted heretofore.

Progress in Tanning Fish Leather.—The Bureau of Fisheries of the Department of Commerce reports excellent progress in the tanning of fish skins. A company formed for this purpose has established stations in North Carolina and Florida for the capture of sharks and porpoises, and it is understood that the number of stations will be increased as rapidly as possible. Another company has recently acquired a site for a fish skin tannery in Washington. Samples of leather recently submitted show a marked improvement over earlier efforts. The leather is soft and pliable, and appears to have ample strength for many uses. The Bureau of Standards is to make tests of the leather product as to durability, porosity, tensile strength, pliability, water absorption, wearing qualities, etc. The nets which the Bureau designed for the capture of sharks are proving successful and will be generally adopted. At the fishery stations the liver oil is extracted and the flesh converted into fertiliser.—(*U.S. Com. Rep.*, *Sept.* 23, 1919.)

GENERAL.

The "Jubilee" of "Nature."—The completion of fifty years of service as a scientific periodical has been most fittingly commemorated by the editor of *Nature* by the publication of a Jubilee number, in which the progress and achievements of science and their applications to industry and the arts are authoritatively reviewed. The first number of *Nature* was published on November 4, 1869, with the object, as stated in the original circular issued on its initiation, of "placing before the general public the grand results of scientific work and scientific discovery and of urging the claims of science to a more general recognition in education and in early life." This, amongst other aims, has been consistently maintained, and the founder, Sir Norman Lockyer, and the present editor, Sir Richard Gregory, are indeed to be congratulated on the conspicuous success of their labours and on the high scientific standard that has characterised the contributions to *Nature* during the past fifty years. Throughout this long period they have secured the co-operation of all leaders of science, they have kept actively in touch with the work of scientific societies both in this country and abroad, and have provided an invaluable medium for scientific discussion. Such contributors and contributions have given *Nature* an exceptional place amongst scientific journals. Its comprehensive character and broad outlook have served to educate and stimulate a wide circle of readers, whilst it has been particularly valuable in directing the attention of workers in science to the progress of discovery in fields other than their own. It is from this standpoint that the reviews in the Jubilee issue will appeal especially to those associated with chemical industry or science. Some forty articles, all contributed by representative authorities, are included in the publication, together with "Valedictory Memories" by Sir Norman Lockyer, and an appreciative account of his life and work by Dr. H. Deslandres, of Paris. The chemical contributions comprise "The Progress of Chemistry," by Sir Edward Thorpe; "Chemistry in the Making," by Prof. H. E. Armstrong; "The Discovery of the Chemical Elements since 1869," by Prof. H. B. Dixon and H. Stephen; "Physical Chemistry—Past and Present," by Prof. J. C. Philip; and an abstract of the address recently delivered by Dr. M. H. Nichols as president of the American Chemical Society on "Research and its Application." Other articles deal with almost every branch of science, with borderland subjects of outstanding importance, such as "Radium and the Electron," "Atoms and Molecules," with technical applications of science, with the teaching of science, and with the promotion of research. All are suggestive, helpful, and full of interest. They constitute an appreciative tribute to the conspicuous services *Nature* has rendered towards the advancement of science and mark a happy augury for the successful maintenance of its influence and utility.

Fabric Structure and Design.—A special committee of the Textile Institute, Manchester, has prepared a scheme for giving effect to a proposal for the advancement of fabric structure, colour, and design in relation to woven cotton and mixture fabrics. Mr. John Crompton, a member of the Council of the Institute, has given a sum of £2,000, the annual revenue from the investment of which is to be devoted to the provision of awards to the designers and weavers of original cotton textile fabrics designed and woven by themselves in technical colleges or weaving schools in the British Empire. It is proposed that, with a view to raising the standard of products in the industry, the Committee of the Institute shall act as a collecting and distributing agency in respect of samples of fabrics.

Financial Developments in the German Chemical "Grossindustrie."—The chief firms represented in the "Interessengemeinschaft" (I.G.) are about to double their capital with a view to developing the nitrogen fixation plants. Forty per cent. of the new capital will take the form of 3½ per cent. preference shares, each share entitling its holder to two votes, and the remainder will be offered at 107 to existing holders on a share for share basis. The object of the preference share issue is, it is stated, to prevent the undertakings passing under the control of foreign interests, which have been busy purchasing shares at their present depreciated values.

The Farbwerke Höchst has issued the following communication relative to these changes:—The agreement arrived at in 1916 between the firms constituting the I.G. provided that in certain cases profits and losses should be restricted to individual companies. This arrangement applied, in particular, to the producers of synthetic nitrogen compounds, *viz.*, the Badische Co., the Bayer-Leverkusen Co., and the A.-G. für Anilinfabrikation in Berlin-Treptow. The magnitude of the nitrogen works no longer corresponds to the capitalisation of the companies operating them, and the completed and projected extensions at Oppau and Merseburg alone necessitate an expenditure of 100,000,000 marks. When all the contemplated extensions have been completed there will be available for German agriculture a yearly supply of 300,000 metric tons of combined nitrogen. As from January 1 next all the firms adhering to the Gemeinschaft will be financially interested in the nitrogen industry. The Farbwerke Höchst is increasing its capital from 90 to 180 million marks, and the other companies are acting similarly; in the case of the Höchst company moderate dividends are promised on account of the present financial year, for the payment of which the reserve funds will be encroached upon, if necessary.—(*Z. angew. Chem., Oct.* 24, 1919, *and other sources.*)

The United States and German Chemical Patents.—According to the *Berliner Boursen Courier*, the object of Mr. Irving H. Keene's recent visit to Germany (this J., 1919, 417 R) was to make private inquiries concerning the proposed purchase *en bloc* of the most valuable German patents relating to dyes and pharmaceutical products by a purely financial company in which both American capital and German chemical industry would be represented.—(*Z. angew. Chem., Oct.* 10, 1919.)

The Iron and Steel Position in Spain.—The Madrid correspondent of the "Comité des Forges de France" describes the present position of the Spanish iron and steel industry as follows:—There are in active operation in Spain 23 blast furnaces, 39 puddling furnaces, 31 open-hearth furnaces, 73 re-heating furnaces, 43 forges, and 2 electric furnaces distributed among 15 establishments, owning about 2000 water h.-p., 53,000 steam h.-p., and 21,000 electric h.-p., and employing altogether about 12,000 workpeople. Their total share capital is £8,600,000, and they have issued bonds for the total sum of £2,680,000.

During the war the iron-ore output fell from 9,861,000 tons in 1913 to 5,551,000 tons in 1917, and that of iron pyrites from 926,000 to 376,000 tons, whilst the wolfram production, the whole of which was exported, increased from 235 to 546 tons. The shortage of coal consequent on the decline of imports from England was to some extent relieved by an increased output from the Asturias collieries. Owing to the heavy orders of the belligerents, the Spanish iron and steel industry enjoyed a period of exceptional prosperity during the war, but with the advent of peace it is faced with a grave crisis, for, owing to its inefficient plants and not too highly skilled *personnel*, it is little likely to hold its own in competition with England and America. The

Government, realising the situation, has decided to come to the aid of the industry, and import duties are to be re-imposed.—(*Iron and Coal Tr. Rev., Oct.* 17, 1919.)

Graphite Deposits in Siberia. On the right bank of the Kureika, a tributary of the Yenisei, in the Turukhan territory, enormous deposits of graphite have been discovered extending for many kilometres in a double layer, the upper one of which is in parts 14 feet thick. The deposits are sufficient to supply all Russian requirements and to provide material for an export trade, which would be facilitated by the inexpensive water transport available. Samples of the graphite show it to be of a steel grey colour and equal apparently to the best pencil graphite. This neighbourhood promises to develop into a new mining district, and the Government proposes to begin operations in the spring either on its own account or through a group of American engineers.—(*Z. angew. Chem., Oct.* 3, 1919.)

Position of the Belgium Chemical Industry.—There were twenty-seven chemical factories in Belgium before the war, and of these only seven were left undisturbed during the German occupation; the remainder was despoiled of most of the equipment material. A number of associations has been formed with a view to securing supplies of raw materials, and these have amalgamated under the title of "Fédération des Industries Chimiques de Belgique." Considerable difficulties are being experienced in the matter of sales. There is little home demand, the market being flooded with foreign products, among which are cheap German goods introduced through Belgian agents. A demand is arising for the prohibition of free imports, and for imports to be granted only to trade associations. Great difficulty is being experienced in regard to exports. Prior to the war Germany was one of Belgium's most important markets, particularly for sulphuric acid, and it is considered that Germany should be made to purchase at least 200,000 tons of Belgian sulphuric acid annually.

The following information regarding the present position of the Belgian chemical industry has been issued by the Comité Central Industriel. There is very little activity in the soda and potash industry. The output of acids amounts to only about 20 per cent. of the pre-war normal. The manufacture of artificial fertilisers is suffering from the lack of mineral phosphate. The dye industry is at a standstill owing to shortage of raw materials. The tar-distilling industry is credited with very little production on account of the small number of coke ovens in operation. There is little doing in the wood-distillation industry owing to lack of timber. The manufacture of explosives is being taken in hand. The match industry is being carried on, but is hampered by the high import duties in foreign countries. In general, there is no activity in the fat and grease industry. The mineral oil industry suffers owing to the high cost of raw materials. The soap industry has restarted operations, but only on a very limited scale. The glue and gelatin works at Hasselt resumed work in May, but the output is only one-third of that of 1914. The two oldest Belgian chemical firms, the Produits Chimiques d'Aiseau, the Produits Chimiques de Moustier and the Société de Superphosphate et Guano, have gone into liquidation, and will be taken over by a new company with a capital of 5,000,000 francs.

A new company with the title of "L'Alliance," with headquarters in Antwerp, is to be formed for trading in vegetable and mineral oils. The capital will be 3 million francs, in 6000 shares of 500 francs each; 2840 shares will be held by the British Petroleum Co., and a like number by the Pétroles Grosny—(Z. *angew. Chem., Sept.* 30, *Oct.* 7, 1919.)

A New Process of Producing Alumina.—According to *Tidskrift för Kemi* (No. 2, 1919), Professors H. and V. M. Goldschmidt, of Christiania University, have worked out a new process of isolating aluminium oxide from the mineral labradorite which occurs in huge masses at Ekersund, Sogne, and other places on the west coast of Norway. This mineral is a mixture of albite ($NaAlSi_3O_8$) and anorthite ($CaAlSi_2O_8$) in the proportion of from 1:1 to 1:3, with an average content of 30 per cent. Al_2O_3. It has been long known that the alumina in labradorite can be extracted with dilute acids, but the Messrs. Goldschmidt were the first to devise a commercial process. They treat the mineral with 30 per cent. nitric acid, whereby silica remains undissolved and the aluminium, calcium, and iron go into solution as nitrates. The solution is evaporated to dryness and the residue ignited at such a temperature that only the aluminium salt is decomposed. The calcium and sodium nitrates are leached out and, after crystallisation, utilised as fertilisers, the alumina being used for the preparation of aluminium salts. The nitrogen oxides evolved during the ignition of the nitrates are recovered as nitric acid. Aluminium sulphate is already being manufactured in quantities sufficient, it is stated, to cover the demand of the paper and cloth industries in Norway, by the Aktiebolget för Elektrotecknisk Industri at Dröbak, but this firm is now experimenting with the Goldschmidts' process.

CORRESPONDENCE.

"BRICKS WITHOUT STRAW."

Sir,—I write in connection with the paper on "Egyptian Bricks," given by Mr. G. Rudd Thompson at a meeting of the Society of Public Analysts, and reported in your last issue (p. 414 R). It may be that the paper itself dealt fully with the theories that have been advanced by others in an endeavour to throw light on the Biblical "bricks without straw," but it seems of interest to recall the investigations of Dr. Acheson, detailed in his interesting account of the steps leading to his invention of the colloidal graphite lubricants "Aquadag," "Oildag," etc. (this J., 1910, p. 246). He found that the difference as regards plasticity, between German and American clays (identical as far as ordinary analysis showed) resulted from a difference in their preliminary treatment. A washing of clay with water containing material, such as tannin, increased its state of subdivision, rendering it much more plastic. Acheson showed that straw treated with water lost 50 per cent of its weight, and that the watery infusion so obtained produced the same effect on clay as the tannin treatment. A sun-dried briquette of treated clay showed a greater tensile strength than a burnt brick of untreated clay. Acheson therefore concluded—and I think very plausibly—that the Egyptians were acquainted with this property of straw infusion, making use of it in their brick-making, and from this arose the outcry when the supply of straw was stopped.

The effect, of course, is a colloidal one. Colloidal matter extracted from the straw exerts a protective action on the finely-divided clay, the particles of which are assumed to be surrounded by the strongly hydrated colloid, and so prevented from coming together to form large aggregates.
—I am, Sir, etc.,

Forest Hill, S.E. ALAN A. DRUMMOND.
Nov. 19, 1919.

PERSONALIA.

Dr. R. H. Pickard, Principal of the Municipal Technical School, Blackburn, since 1908, has been appointed Principal of the Battersea Polytechnic.

An offer of £20,000 has been received by the University of Glasgow from Mr. John T. Cargill, director of the Anglo-Persian and other oil companies, for the foundation of a chair of applied physics.

Prof. J. C. McLennan, who has been acting as scientific adviser to the Admiralty in regard to helium and other subjects, is now returning to his duties as professor of physics in the University of Montreal.

The following appointments have been made to the staff of the Bradford Technical College: Head of Chemical Department, Dr. R. B. Abell; Lecturer in Chemistry, Mr. H. P. Stark; Head of Dyeing Department, Dr. L. L. Lloyd.

Mr. P. A. Molteno and Mrs. Molteno have offered the sum of £30,000 to the University of Cambridge for the erection and maintenance of a building to be used as a research institute for parasitology, provided the University finds the site.

The death occurred at Falkirk, on November 14, of Dr. John Aitken, F.R.S., at the age of 80. Dr. Aitken was a recognised authority on atmospheric pollution by dust particles, and in November, 1918, he was awarded the Royal Medal of the Royal Society for researches on the nuclei of cloudy condensation.

The Nobel Prize for chemistry for 1918 has been awarded to Prof. F. Haber, of Berlin University. Prof. M. Planck, of the same University, and Prof. Stark, of the University of Greifswald, have been awarded, respectively, the 1918 and 1919 Nobel prizes for physics. The award of the 1919 prize for chemistry has been held over.

The King has been pleased to approve of the following awards made by the President and Council of the Royal Society: A Royal Medal to Prof. J. B. Farmer, for his notable work on plant and animal cytology; and a Royal Medal to Mr. J. H. Jeans for his researches in applied mathematics. The Davy Medal has been awarded by the President and Council to Prof. P. F. Frankland for his distinguished work in chemistry, especially that on optical activity and on fermentation; and the Copley Medal to Prof. W. M. Bayliss for his contributions to general physiology and to bio-physics. Among the Fellows recommended for election to the Council are Sir J. J. Dobbie, Sir R. A. Hadfield, Sir W. J. Pope, and Prof. W. P. Wynne.

LEGAL INTELLIGENCE.

Fire and Explosion at a TNT Factory. Claim against Insurance Companies. *Hooley Hill Rubber and Chemical Co., Ltd.,* v. *Royal Insurance Co., Ltd., and Others.* (See this J., 1919, 193 R, 399 R.)

In the Court of Appeal on November 3, counsel for plaintiffs stated that the parties had agreed that the order of Mr. Justice Bailhache as to costs against his clients and in favour of the Royal Insurance Co. should be discharged, and save to that extent the appeal should be dismissed without costs to either side.

Sale of Mineral Jelly for Edible Purposes. *B. Bull v. The Morris Beef Co.*

In the King's Bench Division, on November 5, an action was brought by the plaintiff to recover £2500 as money paid under a contract of June, 1918, for the supply of 100 barrels of "bakers' grease," for edible purposes, at 130s. per cwt. It was contended on behalf of plaintiff that the material supplied consisted of petroleum jelly or vaseline, and expert evidence was given to this effect. The defence denied that there had been a verbal warranty that the material was edible, and stated that the jelly was sold to plaintiff through a third party, who was informed by defendants that they were ignorant of the nature of the material, and that it had been sold to them as bakers' grease or mineral oil and fat.

Mr. Justice Sankey found that plaintiff had established his case, and he entered judgment in his favour for £2245 and costs.

PARLIAMENTARY NEWS.

HOUSE OF COMMONS.

Steel-testing Laboratory, Sheffield.

Mr. Kellaway, in reply to Mr. Neal, said that, with the exception of the laboratory in Sheffield taken over in December, 1917, at an annual rental of £500, all other temporary metallurgical laboratories established during the war have been closed down. A laboratory for testing metals required for artillery equipment and aircraft will be needed so long as such materials are supplied to Government Departments. The future annual cost is estimated at £6,100, and it is hoped to recover an approximately equivalent sum from contractors.—(Nov. 6.)

Soap Manufacture.

Mr. Bridgeman, for the Board of Trade, informed Major Barnes that a sub-committee of the Central Committee appointed under the Profiteering Act is now engaged upon an inquiry into the manufacture of soap.—(Nov. 11.)

Vegetable Oil-seed Products.

In reply to Lieut.-Commander Kenworthy, Lieut.-Col. Amery stated that no preferential duty on the export of palm kernels will be applied to the mandatory areas granted to this country under the covenant of the League of Nations.—(Nov. 12.)

Coal Consumption in Coke Ovens.

The Parliamentary Secretary to the Ministry of Munitions, Mr. J. F. Hope, in a written reply to Mr. Atkey, said the only figures available which indicated the amount of coal carbonised in coke ovens were those for the production of metallurgical coke; these were:—1916, 13,422,195 tons; 1917, 13,801,607 tons; 1918, 13,277,007 tons. In 1917 the sub-division for by-product, bee-hive, and retort ovens was 10,866,673, 2,411,244, and 523,690 tons, respectively.—(Nov. 12.)

Recent Trading with Germany.

Following a question by Mr. A. Short, Sir A. Geddes issued a statement of the total value of the import and export trade between this country and Germany during the period Nov. 11, 1918, to Oct. 31, 1919. The imports from Germany were valued at £217,435, and included potash compounds (other than manures), £53,780; manures, £29,269; and dressed leather, £25,990. The total exports to Germany were valued at £16,207,748, of which

£10,798,973 was in respect of home produce and manufactures; under this sub-heading are included linseed oil, £1,613,396; rape seed oil, £206,499; soap, £480,437. Of the foreign and colonial produce exported, animal and vegetable oils were valued at £111,054; raw rubber, £374,409; unwrought copper, £57,500; and sugar, £60,297.—(Nov. 12.)

Gas Supplies (Calorific Standard).

Sir A. Geddes informed Major Barnes that the suggestion made last June by the Board of Trade to local authorities, that they should refrain from taking proceedings against gas companies in respect of deficient calorific power will have to be renewed until the end of April next, owing to the depleted stocks of coal at gas works.—(Nov. 12.)

Feeding Stuffs and Fertilisers.

In answer to Mr. Sitch, and with reference to the Report of the Consulting Chemist to the Royal Agricultural Society on the marketing of worthless feeding stuffs and fertilisers at excessive prices (this issue, p. 444 R), Sir A. Boscawen said that protection against such fraudulent sales was provided by the Fertilisers and Feeding Stuffs Act of 1906, but the Board of Agriculture was now considering the possible amendment of this Act with a view to giving greater protection to the farmer. Prices of fertilisers are not controlled by law; prices and distribution of feeding stuffs are at present under the administration of the Food Controller.—(Nov. 13.)

Lithopone.

In answer to Mr. Wallace, Sir A. Geddes explained that licences to import lithopone are, as a general rule, granted to firms which imported it during the three months preceding September 1, and at the same rate as during that period. Larger quantities may be imported, under licence, if home producers are unable to supply the demand. He was not aware that there was any difficulty in obtaining licences, and was not prepared to enter into a chemical discussion on the exact formula which represents lithopone, but it has to do with the manufacture of paper.—(Nov. 17.)

Opium Cultivation in China.

Mr. Harmsworth stated, in reply to Sir J. D. Rees, that during the past year there has been a revival of opium cultivation in certain provinces of China, which is mainly due to the present unsettled political conditions. H.M. Government has made strong protests.—(Nov. 17.)

Quinine Sulphate.

Sir A. Geddes informed Mr. Hurd that the delay in publishing the findings of the Committee on Prices and Supplies of Quinine Sulphate was due to the necessity of considering certain legal questions connected with the publication of the Report. —(Nov. 20.)

HOUSE OF LORDS.

Patents and Trade Marks Bills.

These Bills were read a second time on November 12, and committed to a Committee of the whole House for consideration in the week beginning November 24.

The Geological Survey of Great Britain and Museum of Practical Geology, Jermyn Street, S.W., have been transferred for administrative purposes from the Board of Education to the Department of Scientific and Industrial Research.

GOVERNMENT ORDERS AND NOTICES.

IMPORTS AND EXPORTS.

The Board of Trade has announced that Lists "D" and "E" have been cancelled, and that the goods formerly included in them have been replaced on List "A"; these goods include:—Apparatus which can be used for the storage or protection of compressed or liquefied gases, flame, acids, or other destructive agents, capable of use in war-like operations, and their component parts.

It is also announced that castor seed, malt flour, and pig-iron have been removed from List "A" of Prohibited Exports, and that barley, barley flour, and barley meal have been placed on that list (export prohibited to all destinations).

The Export Licence Department has been amalgamated with the Department of Import Restrictions. Applications for licences and all inquiries relating thereto should be addressed to the Director, Imports and Exports Licensing Section, Board of Trade, 22, Carlisle Place, S.W. 1; but applications in respect of licences to import dyestuffs should still be addressed to the Secretary, Trade and Licensing Sub-Committee, Danlee Buildings, Spring Gardens, Manchester.

Import of German Dyestuffs.—The Board of Trade has notified the impending arrival of the first instalment of dyes which are due from Germany under the reparation clauses of the Peace Treaty. Full instructions of the procedure to be followed by intending importers are given in the *Board of Trade Journal* for November 13.

Sugar Supply and Prices.—The Royal Commission on Sugar Supply has issued a notice drawing attention to the need for increasing the selling price of sugar in the United Kingdom, owing to the world's demand having overrun supply. It is noted that the beet sugar production in Europe has fallen by 4,200,000 tons since 1914, whereas the cane sugar production has risen by only 1,800,000 tons. The Food Controller has notified increases in the wholesale and retail prices of this commodity, and fixed the weekly ration at 8 oz. per person. The Sugar Commission has decided that the total amount of sugar to be imported in 1920 shall be at least 500,000 tons less than that imported during the present year.

Order Cancelled.—The Gas and Coal (Emergency) Order, 1919 (this J., 1919, 381 R).

We have received a letter from the Board of Trade (Department of Overseas Trade) calling attention to the fact that cases have recently occurred in which delegations of British industries and trades have visited foreign countries and various parts of the Empire without H.M. diplomatic or consular officers or H.M. Trade Commissioner having been previously notified. The object of the above-named Department is to bring commercial, diplomatic, consular, and kindred services into closer personal touch with British firms, and the Board therefore suggests the desirability of previous notification to this department of prospective visits, together with any other relevant information.

OFFICIAL TRADE INTELLIGENCE.

(*From the Board of Trade Journal for November* 6, 13 and 20.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 4, Queen's Anne's Gate Buildings,

London, S.W. 1, from firms, agents or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department mentioned and quoting the specific reference number.

Locality of firm or agent.	Materials.	Reference number.
Australia.. ..	Chemicals, drugs	1024
,, ..	Copper sulphate (tenders for)..	32,747
British India ..	Glass, enamelware	984
Canada	China, pottery	987
,, ...	Paper	1030
,, (Newfoundland)..	Linseed oil	1031
,, ...	Quicksilver	*
,, ...	Terracotta, floor, wall and roofing tiles	*
,, ...	Drugs	†
,, ...	Chemicals, drugs, oils	†
,, ...	Whiting, iron oxides, lithopone	†
New Zealand ..	Hexagon cold rolled, bright mild steel (1-2 in. diam.)	1033
,, ..	Glass bottles	1034
Malta	Soap, candles. glass, earthenware	1035
Straits Settlements	Chemicals, drugs, dyes, gums, oil seeds and nuts, fertilisers, hides, skins	1038
South Africa ..	Pottery	992
,, ..	Tar or tar substitute (tender for)	553
Belgium	Metals, colours, varnish, chemicals, leather, hides, cork ..	1039
,, ..	Drugs, pharmaceuticals ..	1070
France	Fertilisers	999
,, ...	Chemicals, drugs, medicines ..	1045
,, ...	Skins, leather	1047
Italy	Paper, cardboard	1010
,, ...	Metals, chemicals	1735‡
,, ...	Perfumery, medicines	1737, 1802‡
,, ...	Minerals, chemicals	1740‡
,, ...	Metals, tinplate	1745‡
,, ...	Drugs, soap, chocolate ..	1746‡
,, ...	Drugs, chemicals, cocoa, sugar	1751‡
,, ...	Perfumery, motor oils and greases	1752, 1760‡
,, ...	Chemicals	1753, 1798‡
,, ...	Perfumery, soap, bottles ..	1755‡
,, ...	Soap, perfumery	1756‡
,, ...	Chemicals, dyes	1761, 1764 1778‡
,, ...	Dyes, chlorides, pharmaceuticals	1768‡
,, ...	Chemicals, metals, oil-seeds ..	1781‡
,, ...	Iron, steel, perfumery	1782‡
,, ...	Linseed, castor seed, cotton seed, cottonseed oil, coppersulphate, cocoa	1788‡
,, ...	Oil-seeds, copper sulphate ..	1791‡
,, ...	Oil-seeds, oils, oleo, stearin, chemicals	1793‡
,, ...	Metals, dyes	1797‡
,, ...	Metals	1799‡
,, ...	Steel, technical utensils ..	1800‡
,, ...	Perfumery	1802‡
,, ...	Leather, skins, greases ..	1803‡
Near East ..	Chemicals, oil, paint, colours, soap, pottery	1057
Netherlands East Indies ..	Glass bottles, gas mantles, paint, enamel, soap	1059
Spain	Chemicals, dyes, paint, varnish	1073
Sweden	Chemicals	1014, 1050
Brazil	Chemicals, paper, tinplate, galvanised sheets, cement ..	**
Chile	Zinc white (paste), galvanised and black sheets, cement, benzine, explosives	1021
Ecuador	Galvanised iron, tinplate, cement, glass, crockery ..	1079
Mexico	Perfumes	1080
Peru	Glass, china, crockery, paper, soap, dyes, perfumery ..	1081

* The High Commissioner for Canada, 19, Victoria Street, S.W. 1.
† The Canadian Government Trade Commissioner, 73, Basinghall Street, E.C. 2.
‡ The Secretary, British Chamber of Commerce for Italy, 7, Via Carlo Felice, Genoa.
** The Secretary, Statistical and Information Department, London Chamber of Commerce 97, Cannon Street, E.C. 4.

MARKETS SOUGHT.—A firm in the Netherlands East Indies able to export sugar and copra desires to get into touch with U.K. importers. [1018.]

A Canadian Government Department has for disposal quantities of molybdenite and tungsten concentrates.†

A Canadian firm able to export asbestos millboard and asbestos manufactures desires to get into touch with U.K. importers.†

TARIFF. CUSTOMS. EXCISE.

Argentina.—Among the articles still on the list of prohibited exports are scrapped copper, brass, steel, aluminium, antimony, tin, zinc, lead, iron, tin-plate, galvanised iron; sugar.

Australia.—Import licences are now required for absolute alcohol, amyl alcohol, ether, ethyl acetate and chloride, cocoa and chocolate (potable), many metals and alloys, coal-tar oils, certain colours and paints, carbolic and cresylic acids, naphthalene, arsenates of lead, lime and soda, arsenites of soda and zinc, arsenic, arsenic sulphide, sodium sulphate, etc.

The prohibition of the import of soda, caustic soda, sodium sulphide, white lead and red lead has been revoked.

Certificates of origin are still required for all goods imported from Belgium.

Foreign dyes from stocks in the U.K. may be imported from the U.K. under certain conditions.

Austria.—Import licences are required for all goods, and licences will only be issued under certain conditions of price and payment.

The export of raw materials, food, and clothing is prohibited except under licence. The export of other goods is free, but the export of all goods is subject to conditions of payment.

Belgium.—Among the articles for which export licences are still required are bones, cement, dephosphorisation slag, certain kinds of hides, oil-seeds, metal waste, steel, sulphate of ammonia and superphosphates.

Belgium has given notice to withdraw from the International Sugar Convention as from Sept. 1, 1920.

Bulgaria.—Among the articles which may now be imported without previous permission are soap powders, soda, bicarbonate of soda, caustic soda, mineral oils and yeast. The full list may be seen at the offices of the Department.

Chile.—It is proposed to increase the customs duty on certain metals, cement, glass, pottery, zinc white, lithopone, paper and certain chemicals.

Czecho-Slovakia.—Among the articles for which a general import licence will be granted are many metals and their salts, certain chemicals, aniline dyes, some minerals, asphalt, benzol, celluloid, copal, fertilisers (except superphosphates), vegetable fibres, grease, hides, optical glass, certain vegetable oils, mineral oils, resin, rubber, shellac, starch, tanner's bark, waxes and wood.

Among the articles urgently needed are acetone, barium peroxide, citric acid, dyewood extracts, essential oils, paraffin, resin, tanning extracts, tartaric acid, turpentine, carnauba wax, iron sheets, leather, drugs, ferro-manganese, edible and lubricating oils.

East African Protectorate.—The prohibition of the import of sisal hemp, waste and tow has been revoked as from Sept. 3.

Egypt.—The revised regulations respecting the export of goods to all destinations are set out in the issue of Nov. 13. Among the articles for which export licences are still required are alcohol, benzine, biscuits, cattle foods, cocaine, morphine, opium, extracts of hemp, coconuts, dyes, edible fats, gold, groundnuts, kerosene, chemical manures, margarine, molasses, nuts and oils of all kinds, silver, soap, starch, sugar, and wood.

France.—Recent customs decisions affect cellophan, ferro-zirconium, silico-zirconium and hardened casein.

For the present only, rum and tafia from cane grown in French Colonies may be imported into France.

A full statement appears in the *Bd. of Trade J.* for Nov. 6 of the proposed revision of customs duties on chemical products.

French Colonies (other than Tunis and Morocco). The list of prohibited exports is the same as that for France, except that the export of beetroots from the French Colonies is permitted.

Gold Coast.—The export duty on cocoa has been increased to one halfpenny per pound.

Greece.—The import of copper sulphate and sulphur is prohibited until Oct. 3, 1920.

Italy.—White paper in rolls for newspapers may be imported free from customs duty until Dec. 31.

In order to secure the "conventional" (lower) rates of customs duty, goods of U.K. origin must be accompanied by certificates of origin.

Japan.—As from Nov. 1, the customs duty on benzyl alcohol is fixed at 20 per cent. *ad valorem.*

Morocco (French Zone).—The import of all German goods is prohibited for the present.

Netherlands.—The prohibition of the export of raw kapok and all spirits other than those suitable for immediate human consumption has been temporarily raised.

New Zealand.—The import of saccharin is prohibited unless manufactured in some part of the British Dominions.

Paraguay.—The export duty on quebracho extract has been increased to 8 dollars (gold) per metric ton as from Sept. 20.

Sierra Leone.—The revised rates of export duty on palm kernels, palm oil and kola nuts comes into force on Jan. 1, 1920.

South Africa.—The export of sugar is prohibited except under permits granted only to the Natal Sugar Association.

The export of gold coin, gold bullion and gold ornaments is prohibited except under permit.

Spain.—The import duty on sugar up to 40,000 metric tons is fixed, for the next ten months, at 35 pesetas per 100 kilo.

Straits Settlements.—The import of dyes not manufactured in the British Empire is prohibited unless a licence has first been obtained from the Governor.

Sweden.—Export prohibitions have been removed from, *inter alia*, cork, vegetable fibre, resinous oils, lead ashes and tanning extracts.

COMPANY NEWS.

NITROGEN PRODUCTS AND CARBIDE CO., LTD.

The fifth annual meeting was held in London, on November 11, at Winchester House, E.C. Major C. H. Campbell, who presided, said that the profit for the 18 months under review was £118,814, from which a dividend of 9 per cent. had been paid, £10,000 placed to reserve, and £14,396 carried forward. A claim against the German Government in respect of the occupation of the works at Vilvorde had been lodged with the Foreign Claims Office, and this, together with other claims due to the affiliated Nitrogen Fertilisers, Ltd., amounted to over £270,000. The considerable loss on the works at Dagenham was due to the necessity, imposed by war conditions, of using gas liquor instead of cyanamide as a source of ammonia. The company's plant was designed for the latter process and could not be operated for the former without loss. The Government authorities were very unsympathetic. The company's process was adopted by the French Government, which voted about £15,000,000 for general development purposes, and in September, 1915, started the construction of a large factory at Angoulême, utilising the designs and technical assistance of the company. According to reliable information, the use of the Haber process is not likely to extend far beyond the district in Germany where it has been developed. It is very intricate, very expensive, and is dependent upon coal fuel.

During the period under review an offer was accepted from the Alby Carbidfabriks, Sweden, to buy up all the shares in it held by Nitrogen Fertilisers, Ltd., at a price which gave the latter a profit of over £345,000. The value of the company's properties in Norway was very great, and particularly the Aura Water Power concession, which is capable of giving 250,000 h.-p. per annum. The development of the property is now to be accelerated. The Toke water rights have been sold to the Norwegian Government at a good profit. There is a great future for Norwegian water-power in the electric smelting of iron ore, the manufacture of cyanides etc. In this country the directors had continued their extensive trials to ascertain the most economical means of producing power from coal, and realising that successful carbonising must be carried out at the pithead, they have purchased the St. Helen's Colliery and brickworks at Workington, Cumberland, together with a battery of 40 coke ovens with by-product recovery.

The production of "nitrolin" had to be diverted to the manufacture of explosives in 1916, but by that time its popularity had become well established; there was a great future for such artificial fertilisers once their value had been fully appreciated.

Subsequent to the meeting an extraordinary general meeting was held at which resolutions were passed sanctioning the winding-up of the company and its amalgamation with Alby United Carbide Factories, Ltd.

ALBY UNITED CARBIDE FACTORIES, LTD.

The twelfth annual general meeting of this company was held in London on November 11, Major C. H. Campbell presiding.

The chairman stated that the net profit for the 18 months ended December 31, 1918 (after writing off £34,000 for depreciation) was £25,595; after paying the interest on the preference shares and 6 per cent. on the ordinary shares, £6837 was left to be carried forward. The company has received dividends from the North-Western Cyanamide Co., Ltd., the A/S Meraker, which produces ferro-alloys, and the Nitrogen Products and Carbide Co., Ltd.

Very unsatisfactory treatment had been meted out to the company by the Government authorities during the war. Losses had been incurred owing to the enormous rates of freight on the carriage of coal to Norway; and the Government paid very much lower prices for the carbide than were obtainable from other consumers, and then made large profits by reselling to munition factories. An offer by Norwegian financiers to purchase the whole of the Norwegian assets was declined on the instigation of the Foreign Office, and the company was compelled to accept contracts which showed little or no profit. The Coal Controller enforced the payment of the same prices for coal which were charged to neutrals, with the result that the coal purchased cost more than double the price paid by other British and by Allied firms. Prices of materials and labour and of hydro-electric power in Norway are now 150 per cent. above pre-war prices, which means a very heavy expenditure on constructional work. Excellent progress has been made at the electrode works at Hebburn-on-Tyne, and the quality of the electrodes supplied has been very

greatly improved. The company will continue the policy of running its own steamers; the patent rights held by it are considered to be very valuable; and a financial interest has been taken in several undertakings producing compressed acetylene. The future appears to be secured, trade is improving and the demand for calcium carbide has exceeded expectations.

The resolutions embodying the proposals to amalgamate with the Nitrogen Products and Carbide Co. were passed at the extraordinary general meeting which followed. The capital of the company will, accordingly, be increased to £2,332,916 by the creation of 1,607,916 new ordinary shares of £1 each, ranking *pari passu* with the old; of these new shares 1,499,965 will be allocated to shareholders in the Nitrogen Products company, and 80,261 to shareholders in the Alby United company, leaving 27,690 unissued.

REPORT.

Report of the Consulting Chemist to the Royal Agricultural Society, 1918. *Journ. Roy. Agric. Soc., Vol. 79.* (*London: John Murray.*)

In discussing the great difficulties which the farming community has experienced during 1918, attention is drawn to the passage of various Orders controlling the prices of fertilisers and feeding-stuffs. These Orders would have been of greater advantage had they been made applicable to *all* classes of these commodities, but, as matters stood, while the price and quality of certain articles were controlled, a large number of almost worthless materials were sold as food for stock without any control whatever. Of 64 samples of compound feeding meals examined in 1918, over one half were being sold at prices considerably beyond their value. In other words, the Orders tended to encourage the sale, at exorbitant rates, of mixtures frequently composed of waste materials that had escaped being "controlled."

In several samples of feeding materials undesirable and even injurious materials were found. Thus, castor oil bean was found in some compound feeds, mustard seed in rape cake, and salt in excessive amount in foods for pigs and poultry. Cases of loss of and injury to stock arising from these causes are recorded.

The conditions in respect to fertilisers were more satisfactory, a system of control of prices with quality being instituted, and in this connexion it may be noted that the sale of basic slag according to "solubility in citric acid" was practically abolished. Attention is drawn to the dangers likely to result from the continuous application to the land of acid and forcing manures such as superphosphate and sulphate of ammonia, but it is indicated that there need be little fear of these injurious effects if the regular practice of liming or chalking the soil were re-introduced.

In a more detailed account of samples received for examination during the year, attention is drawn to the following points of interest. Several samples of rice products were of very poor feeding quality, one containing 28·76% of woody fibre and 16·46% of silica, whilst a second contained 23·71% of woody fibre and 10·5% of silica.

A sample of fish meal, containing a large amount of salt, was harmful to pigs, and, in another instance, a "pig meal," which had 7·29% of salt, caused the death of five out of eight young ducks to which it was fed.

Two samples of dried milk, damaged and unfit for human consumption, on analysis showed respectively, fat 24·70%, casein 24·63%, milk, sugar, etc., 40·18%; and fat 19·36%, casein 26·31%, milk sugar, etc., 41·27%. These would have made a very useful food for pigs.

A sample of Carrageen Moss (seaweed), collected in Co. Donegal, and said to be used locally for human food, had oil 0·20%, protein 13·56%, carbohydrates, etc., 68·99% woody fibre 2·59%, mineral matter 14·66%, reckoned on the moisture-free material. It was very clean, contained only 0·06% of sand and 0·20% of salt, and undoubtedly possessed high feeding properties.

The results of analyses of flue dusts recorded show the variable nature of this material, according to the source. The samples were, as a rule, alkaline in reaction, but were seldom found to contain constituents injurious to crops.

A sample of tannery refuse was found to contain 41·92% of lime, and as it could be carted away free, should have proved useful on land in need of lime, despite the difficulty of applying it owing to its wet condition.

Attention is drawn to the fact that some agricultural limes are being sold which are not derived from carboniferous limestone or chalk, but are largely magnesian in character, and thus of doubtful suitability for agricultural purposes.

TRADE NOTES.

FOREIGN.

Foreign Chemical Trade of Brazil.—The subjoined table shows the quantities of some of the more important chemical products imported from the countries named during the years 1913 and 1916. There are no figures available giving the present consumption of caustic soda, carbonate of soda, and bicarbonate of soda, but, in view of the large number of cotton mills in Brazil, the consumption of the first two of these must be very great. These products were formerly imported from Great Britain, but have been supplied by the United States during the war. The Brazilian Government is encouraging the establishment of caustic soda factories, and one is now in course of erection at Santos. Washing soda is manufactured from soda ash by two local firms—Messrs. Holland & Co., Rio

IMPORTS INTO BRAZIL (TONS).

Country of origin.	Chloride of lime.		Caustic soda.		Fine chemicals.		Potash carbonate.		Acetic acid.		Sulphuric acid.		Acids not specified.	
	1913.	1916.	1913.	1916.	1913.	1919.	1913.	1919.	1913.	1916.	1913.	1916.	1913.	1916.
Germany ..	257	—	115	—	6,823	3	143	—	128	—	470	—	139	—
Belgium ..	3	—	14	—	124	5	1	—	3	2	31	—	2	—
United States ..	7	470	66	7,267	424	4,903	10	685	1	146	1	126	5	56
France	4	—	2	—	1,786	1,613	6	2	—	—	10	—	140	17
Great Britain ..	740	517	7,263	2,948	5,648	5,162	6,864	4,142	97	78	121	11	99	36
Italy	—	—	—	—	372	155	10	—	—	—	—	—	17	18
Holland	—	—	—	—	71	3	—	—	72	16	151	—	9	1
Portugal ..	—	—	—	—	276	582	—	—	—	—	—	—	—	—
Total imports ..	1,013	993	7,581	10,327	15,936	12,759	7,078	4,838	315	247	800	155	417	145

de Janeiro, and L. Queiroz, Sao Paulo—the former of which is reported to have sold its interests to an American citizen. The principal manufacturers of fine chemicals are the above-named firm of L. Queiroz and Messrs. Granado and Co., of Rio de Janeiro, and the first of these also makes sodium sulphide, which is used as a depilatory in nearly all the tanning factories.

The Chemical Market in France.—Potash salts are fetching higher prices, especially the carbonate. It is remarkable that glass manufacturers should still prefer to use the high-priced carbonate of potash, derived from beet molasses, when a supply of the much cheaper chloride is available from Alsace.

The prices of sodium salts are also rising; ferrocyanide and ferricyanide are quoted at 1500 francs per 100 kilo.

The prices of vegetable oils are expected to fall within a short time owing to the successful harvest. The demand for soaps is strong, and prices are steady.

Stocks of rubber are diminishing on account of the heavy demand of the Central Powers.

The production of phosphatic manures is far behind the demand. The success attending the prospecting of phosphate beds in Egypt—which compare favourably with those in Algeria and Tunis—is not affecting the market, because the actual and prospective shortage precludes all fear of keen competition.

The Bohemian Glass Industry.—During the existence of the monarchy about 80—90 per cent. of the Bohemian glass production was sold at home and only 19—20 per cent. was exported, but now the home requirements are at most only about 20 per cent. of the output. A development of the export trade is therefore necessary to the industry, and, provided the present restrictions are removed, it is likely to occur, for the whole world is in need of window glass.—(*Z. angew. Chem.*, *Oct.* 3, 1919.)

Olive Oil Situation in Italy.—Last year's olive oil production in Italy, although exceeding the past ten years' average, did not provide for the annual consumption, which is estimated at 1,500,000 quintals. The most favourable estimate for next year's production is 1,300,000 quintals. The actual deficiency will, however, be higher than these figures indicate because redeemed territories must be supplied, and these are almost without edible oils and fats, and butter will be scarce. Consequently, olive oil must be imported and the external market prices must be paid. Two policies are open to the Government: (1) to sell imported oil at domestic fixed price, Government bearing the loss; (2) to raise price of domestic oil to that of imported oil.—(*U.S. Com. Rep.*, *Oct.* 16, 1919.)

Exports of Bismuth, Mica and Asbestos from Hongkong.—Bismuth, a by-product of the wolframite mined in South China, is being shipped in the form of oxide from Hongkong in increasing quantities. It is obtained by coolies or farm people from surface outcrops or pockets, and collected and disposed of by Chinese brokers to foreign brokers or exporters. The present production of this ore is from six to ten tons per month, rather more than 10 per cent. of the world's supply. Most of the wolframite and all the bismuth exported from Hongkong is collected by coolies by very primitive means. Shipments of bismuth this year to beginning of August were worth about £20,500; 60 per cent. went to Great Britain and the rest to the United States.

Export of mica and asbestos from Hongkong is commencing. Hitherto the quality of these minerals has been doubtful; asbestos of excellent quality is, however, now being worked by a Chinese syndicate for the American market. Some mica deposits are being worked similarly.—(*U.S. Com. Rep.*, *Oct.* 18, 1919.)

Rapprochement between the Metal and Chemical Industries in Germany.—With the object of rendering more intimate the business relationships between the three firms, two directors of the Badische Anilin- und Soda Fabrik have been elected to the board of the Metallbank und Metallurgische Gesellschaft of Frankfurt, and one of these (Dr. K. Bosch) has also been elected to the board of the Deutsche Gold- und Silber-Scheideanstalt (which has just declared a dividend of 20 per cent.). No fusion of capital of the three companies is involved.—(*Z. angew. Chem.*, *Sept.* 5, 1919.)

Use of Liquid Air for Mining in Sweden.—An explosives company is erecting seven factories in Sweden for the production of liquid air, in the first place at Kiruna, Malmberget, Grängesberg, Gyttorp and Hagge, whence the various mines will be supplied. Since the necessary machinery could not be obtained in Sweden at moderate prices it was ordered from Germany. The total outlay will be about 1·5 million kroner.—(*Z. angew. Chem.*, *Sept.* 19, 1919.)

Production of Wolfram in Peru.—The activity of wolfram mining in Peru fluctuates with the prevailing prices in Liverpool and New York. It is conducted in a very primitive manner by the Indians, chiefly in the districts of Conchucos and Corongo. The concentrates (58—60 per cent.) are transported over the mountains on the backs of llamas and burros to the railways connecting with the ports of Salaverri and Chimbote. The cost of mining and delivery on the coast is considered to be very low.

EXPORTS OF TUNGSTEN ORE CONCENTRATES FROM PERU, 1913-1917.

	Metric tons.	Value. £	Destination %.
1913	290	19,460	Germany 52; U.S.A. 41; France 2·7; U.K. 4·5.
1914	196	20,400	Germany 62·5; U.S.A. 4·6; France 0·9; U.K. 13·3; Italy 19.
1915	339	52,000	U.S.A. 85; France 2.3; U.K. 12·6.
1916	524	226,850	U.S.A. 98·7
1917	417	101 045	U.S.A. 100.

—(*U.S. Com. Rep.*, *Sept.* 22, 1919.)

OBITUARY.

DR. H. C. GREENWOOD.

We record with deep regret the death, from blood poisoning, of Harold Cecil Greenwood, at Winnington Hall, Northwich, Cheshire, on November 4, at the early age of thirty-two. Dr. Greenwood was a Mercer Scholar of Manchester University, where he graduated as B.Sc., with first-class honours in chemistry, in 1907, subsequently obtaining the degrees of M.Sc. and D.Sc., an 1851 Exhibition Scholarship, and a Beyer Fellowship. He worked for a time with Prof. Haber, at Karlsruhe, on the synthetic production of ammonia and published a joint paper with him on this subject. His work in this country included investigations on ferro-alloys, very important determinations of the boiling points of metals, the specific and latent heats of aluminium and zinc (at the National Physical Laboratory), and from 1916 until quite recently he did excellent service with the Munitions Inventions Department of the Ministry of Munitions on the synthesis of ammonia, his researches on this subject leading to distinct improvements in the process. Dr. Greenwood, whose early death is much to be deplored, was a member of the Committee of the Chemical Engineering Group of this Society, and a paper by him and Mr. A. T. S. Zealley on an apparatus for estimating oxygen in combustible gases and of combustible gases in air appeared in the April 15 issue of this Journal.

REVIEW.

Catalysis in Theory and Practice. *By* E. K. Rideal *and* H. S. Taylor. *Pp.* xv. + 496. (*London: Macmillan and Co., Ltd.*, 1919.) *Price* 17*s. net.*

In this volume, which is excellently printed on good paper, well illustrated, and provided with two indexes, the authors have made a valuable contribution to English chemical literature. Although the unnecessarily dogmatic statement in the preface, that a chapter in Mellor's *Chemical Statics and Dynamics* "has formed, hitherto, the sole treatment in English of the theoretical aspects of the subject," does less than justice to Mr. Jobling's interesting and useful little monograph, it must be recognised that there has been, hitherto, a distinct need for a more comprehensive treatise on the important subject of catalysis.

The subject-matter and scope of the book under review may be appreciated from the following list of its contents: History and Theoretical (61 pp.); Measurement of Reaction Velocity (13 pp.); Oxidation Processes (13 pp.); Hydrogen and Hydrogenation (81 pp.); Dehydrogenation (51 pp.); Fixation of Nitrogen (23 pp.); Hydration and Hydrolysis (18 pp.); Dehydration (35 pp.); Applications to Organic Chemistry (30 pp.); Ferments and Enzymes (33 pp.); Catalysis in Electrochemistry (47 pp.); Catalysis by Radiant Energy (17 pp.); Catalysis in Analytical Chemistry (27 pp.).

Apart from the use of a few unnecessary Americanisms, such as "viewpoint" for "point of view," and "a plot" for "a graph," and one or two clumsy sentences (such as that at the bottom of p. 362), the style of the book is clear and fluent. Many portions of the subject-matter, however, give the impression that the writing and proof-reading have been somewhat hastily done, and the unusually large number of mis-spelt names (*e.g.*, "Thenard" for "Thénard," "Ripple" for "Ripley," "Paen de St. Gilles (or Giles)" for "Péan de St. Gilles," "Buchbock" for "Buchböck," "De Hahn" for "Hahn," "Tessio du Motay" for "Tessié du Motay," "Carenwinder," for "Corenwinder," Brodie" for "Brode," "Payer" for "Payen," and "Messell" for "Messel") seems to indicate either careless proof-reading, or a neglect to go back to the original sources, which is hard to excuse in a book of this kind. One rightly requires of the authors of monographs a thorough acquaintance with the original sources.

Some of the descriptions of technical processes (*e.g.*, of the Chamber Process, p. 77) are not entirely accurate. The section on Tautomerism does not represent the latest stage in the progress of the subject, as the important work of Kurt Meyer is referred to only very briefly, and no mention is made of Lapworth's work on the bromination of acetone. In the section on the oxidation of ammonia, "silica" is mentioned as a catalyst poison when silicon hydride is meant; and the note as to recent work on the vexed question of the influence of sulphur, phosphorus (*sic*), and acetylene on the reaction does not lead the reader to suppose, what is actually the case, that the only information we possess at present is so conflicting as to be worthless. The reference to thermodynamics on p. 18 is not clear; as far as the reviewer understands it, the statement is inaccurate. The allusion to "foxy batches" in the Weldon process as "red solutions" should be to "red precipitates," and it is surely incorrect to speak of spent-oxide as "an artificial sulphide." These are typical of numerous minor inaccuracies which might well have been avoided.

The authors evidently (pp. 19 and 28) take Ostwald's "whip and oil theory" seriously, although they appear to have misgivings as to the real value of the contributions of this writer to the theory of the subject. Ostwald's superficial analogies, and his misdirected criticism of honest attempts to find rational explanations of the causes of catalytic action (which, as the authors correctly emphasise, are probably different in different groups of reactions), have done a good deal to retard progress in this branch of the subject. The authors give a judicial and impartial account of the different theories which have guided workers in this field.

The section devoted to hydrogen is probably the best in the book, and contains a great deal of information, excellently arranged and critically treated. It is interesting to find that one Joseph Jacob, in 1861, "claims the commercial production of hydrogen by the action of steam on iron filings or borings": doubtless he had seen the experiment performed in some lecture before his "invention" took its final shape. Of the other sections, that on ester hydrolysis may be especially mentioned as a careful and accurate account of recent work, and other valuable and interesting discussions are those dealing with the purification of coal-gas, catalysis by radiant energy, the cracking of oils, and enzymes.

This monograph is one which no chemist, whether engaged in academic or industrial work, can afford to be without. The primary need of British chemical industry in the difficult years to come is information, and no one who has followed the recent triumphs of applied chemistry in our own and other countries will dispute for a moment the fundamental importance of catalytic processes in all branches of the science.

J. R. Partington.

PUBLICATIONS RECEIVED.

Alcohol: Its Production, Properties, Chemistry, and Industrial Applications. *By* C. Simmonds. *Pp.* viii.+574. (*London: Macmillan and Co., Ltd.*, 1919.) *Price* 21*s*.

Report on the Statistical Work of the Factories Branch. (*Technical Information.*) *Ministry of Munitions, Department of Explosives Supply. Pp.* 202. (*H.M. Stationery Office.* 1919.) *Price* 4*s*. 6*d*.

Practical Leather Chemistry. *A Handbook of Laboratory Notes and Methods for the use of Students and Works' Chemists. By* A. Harvey. *Pp.* 207. (*London: Crosby, Lockwood and Son.* 1920.) *Price* 15*s*.

La Réorganisation de l'Industrie Chimique en France. *By* Eugène Grandmougin *and* Paul Grandmougin. *Pp.* 277. (*Paris: H. Dunod and E. Pinat.* 1918.) *Price Frs.* 12.50+20%.

The Industrial Council for the Building Society. *Published under the auspices of the* Garton Foundation. *Pp.* 153. (*London: Harrison and Sons.* 1919.) *Price* 1*s*.

Tin Ores. *By* G. M. Davies. *Monographs on Mineral Resources, with special reference to the British Empire. Imperial Institute. Pp.* 111. (*London: John Murray.* 1919.) *Price* 3*s*. 6*d*.

Manganese Ores. *By* A. H. Curtis. *Monographs on Mineral Resources, with special reference to the British Empire. Imperial Institute. Pp.* 118. (*London: John Murray.* 1919.) *Price* 3*s*. 6*d*.

THE LIBRARY OF THE CHEMICAL SOCIETY.

Whilst the progress of chemical research and of chemical industries is essentially associated with laboratories and works, the provision of a comprehensive and accessible library forms an essential adjunct whereby the tools of activity may be sharpened and "costing" in respect to redundant labour efficiently reduced. In the larger works and laboratories the value of this provision has become increasingly recognised during recent years, especially in respect to current publications, but the majority of workers in chemical science has little opportunity of access to any chemical literature beyond that associated with a narrow field of vocational requirements, and many are not even favoured with this limited supply. Whatever the extent of such provision, a central library is a central need for all. The building up of a really comprehensive collection of books on even one subject is a work of many years, requiring a continuous policy of wise discrimination and careful direction. From this fundamental point of view the Council of the Chemical Society is to be sincerely congratulated on having taken advantage of that fuller association of science and industry which has been such a hopeful outcome of the war to bring its library within the membership of kindred societies and to extend it towards their more special requirements.

London has long lacked a representative and accessible library of chemical literature, and the action of the Council of the Chemical Society is a first and helpful step to fulfil this need. The conditions that initiated this action have been recently described by Mr. F. W. Clifford, the Librarian of the Chemical Society, in the August number of the *Library Association Record*, where an interesting account is given of the development of the scheme, and a fitting tribute paid to the work of Prof. J. M. Thomson who, as chairman of the Library Committee of the Chemical Society, has contributed very largely towards its realisation.

The following societies and associations have cooperated in the extension by giving financial support to the scheme, and their members now have full use of the library, both for loan and reference, under the conditions notified in this Journal (1919, 77 R):—The Association of British Chemical Manufacturers, Biochemical Society, Faraday Society, Institute of Chemistry, Society of Chemical Industry, Society of Dyers and Colorists, and the Society of Public Analysts and other Analytical Chemists.

To no members of any contributing society is this co-operation likely to be more welcome than to the members of the Society of Chemical Industry. The Council of the Society can rest assured that its contribution towards this development, despite the financial difficulties of the past years, is as fully justified as it is appreciated. Access to the excellent initial library of the Chemical Society, which contains some 23,000 volumes, is in itself an invaluable boon, to which the extension of its scope on the technical side and, to London members, the extension of the library hours form most welcome additions.

Whilst this successful co-operation exemplifies the economy with increased efficiency that can be effected by mutual effort, it is to be hoped that it will also serve as an active stimulus towards further development. The present accommodation available for the library is very inadequate and is lacking in accessories for congenial reading which could add much to its comfort and attractiveness. In addition there is much to be said for a full provision of patent literature and arrangements whereby the inquiries of members for information could be facilitated. The establishment of a Central Chemical House would undoubtedly be the best means of providing these desirable requirements, and there is no better basis of appeal for the carrying out of this long-cherished hope than the urgent need for a central library worthy of the country and of the great national services rendered by chemical science and chemical industry.

The time is opportune to give such aid to the tools of scientific progress and research. The claims of chemical science have never been so urgent as to-day; they have never more fully merited recognition. Surely amongst the 5400 members of this Society there are some who, by an initial gift, could provide the means for bringing this important development nearer realisation.

THE OUTLOOK FOR BRITISH CHEMICAL INDUSTRY.*

E. F. ARMSTRONG.

It is more than doubtful if the importance of the chemical industry has ever been properly appreciated in this country; at all events under war conditions its deficiences were glaringly exposed to the public eye. Although our industry "made good" in a manner unsurpassed by any other, and its achievements have recently been proclaimed by our professorial colleagues, there are lamentably few signs either that the public or Government Departments appreciate its problems or that they are prepared to help in their solution. This is in a large measure due to the diverse character of an industry in which outputs vary from thousands of tons to a few ounces.

Individuality, that marked and most valuable British characteristic, has led in the chemical industry, as elsewhere, to the formation of a number of separate and, generally, small firms, which trade with one another, and consequently incur large expenditure on transport and related charges. In Germany the development has been on other lines, and has resulted in the establishment, particularly on the banks of the Rhine, of huge factories in which all stages of manufacture are carried out. The German chemical industry may be said to be better balanced than our own, and this has been a prime factor in its success. The German dye industry in particular owes much to the co-ordination effected between the manufactures of heavy chemicals, intermediates, the dyestuffs themselves and the proprietary articles made from their by-products, within the boundaries of a single factory.

As is well known, the German firms have established a very far-reaching community of interests, known as the I.G. (Interessengemeinschaft), which involves a pooling of interests without sinking the individuality of the various firms concerned. Manufacturers of heavy chemicals, intermediates, dyes, and fine chemicals, and even suppliers of plant, were all involved in this pool so that the I.G. almost attained a position of domination in the chemical trade of the world before the war. The technical efficiency achieved by the combine resulted in such low production costs that the imposition of import duties to keep foreign competition out of the home markets was rendered unnecessary.

* Chairman's Address to the Liverpool Section, November 17, 1919.

The commercial methods employed by the I.G. have been criticised adversely, and public opinion to-day both here and in America is opposed to trusts. On the other hand, the potentialities of an enterprise, organised for immense output, and relying on a large and rapid turnover with a small percentage of profit, are such as to lead to the conclusion that organised mass production is a necessary and unavoidable future development.

The contrast between Great Britain, Germany, and the United States in the trade contest before the war has been admirably expressed recently in *Sperling's Journal*.

"Great Britain was represented by a multitude of small, rather old-fashioned, manufacturing units, each maintaining its own agencies of sale and distribution, not at all alive to science, stubbornly individualistic both in their products and in their attitude towards other British firms in the same industry with whom they were competing far more fiercely than with the Germans or the Americans, conscious that the smallness of their installation made for inefficiency and waste, but deterred from scrapping and rebuilding them on modern lines by the almost prohibitive cost, and, in the meantime, though with increasing difficulty, retaining a considerable share of the business in markets that British enterprise had been the first to exploit. Germany and the United States, on the other hand, tended more and more to be represented by huge plants, producing a limited variety of commodities in enormous quantities, employing a large body of highly-trained technologists, relying very greatly on specialisation and repetition work, arranging the amount and character of their output by agreement with other firms, disposing of their products through collective selling and distributing agencies; and by thus pooling their resources and organising each industry as a whole, they were enabled to command ample credit, and to marshal most formidable forces against whatever point they selected for attack."

There cannot be the least doubt as to which of these two opposing policies and conceptions is destined to prevail. If we are to have a British chemical industry in the fullest sense of the word, far more attention must be paid to the all-important question of the co-ordination of its branches.

Success in chemical industry depends on the following factors, which are not necessarily arranged in order of importance: Commercial management, technical management, chemists and research staff, engineers, labour.

It is maintained that in addition to ordinary commercial ability the board of a chemical company must include men with the highest technical qualifications. In no other industry do technical considerations play so large a part in the success of the undertaking, and it is essential that men with a full grip of the problems shall have the predominating word in the manner of their solution. The practice of the technical manager submitting a report to a non-technical board can only be detrimental to the firm, and it has often proved to be so in the past. German chemical industry owes much of its success to the fact that technical men of great and even outstanding ability have had the deciding voice in shaping its destinies; in this country it has been otherwise, and probably this is one of the most needed reforms if success is to be ours.

Technical management is a complex subject which appeals especially to the members of our Society, since most of us act in this capacity. The successful manager must be a modern Admirable Crichton, able to get the best alike out of his workpeople and his plant, with both a wide outlook and a grip of detail, and in full sympathy with the laboratory. Unfortunately, with but few exceptions, the positions which demand these qualifications do not command a remuneration sufficient to attract the best type of Englishman, namely the ex-public school boy of the class which has done so much in the administrative services of the Crown to make our Empire what it is. Unless something can be done to bring this type of man into industry, in the future we shall always be hampered in competition with America, which is singularly fortunate in being able to attract her best blood and brains into the works. This is not the place to discuss the vexed question of the training necessary either at school or the university, though it is one which even yet has not been sufficiently ventilated.

The position of the chemist in chemical industry is many-sided. He may be an analyst, a process controller, a research chemist, or be engaged in transfering operations from the experimental to the large scale. Whatever his duties and his previous training, his success depends on his ability to adapt himself to the mental atmosphere of the works. Success of the industry depends on the co-ordination of many factors; the chemist is but one link in the chain, and as such he must submit to discipline. Obviously, in a chemical works a scientific atmosphere should prevail at least as far as the exercise of scientific control, though it is to be feared that this has not always been the case in this country. Probably in no other industry is there such danger of an established process being suddenly put out of competition by a new invention. Necessarily, therefore, the research staff of a chemical works must always be on the alert for new methods, and the future of the establishment will largely depend on its success. It is obvious that only large undertakings can afford to keep a really large staff of research chemists, and this fact is probably one of the reasons for the supremacy of the great German firms.

In Germany, moreover, even in small firms, the man in charge is an academically trained chemist; in this country he is usually a business manager or engineer, the chemist, if any, being relegated to a subordinate position in the laboratory. In consequence, the smallest German works are technically highly efficient. This factor was rightly held to be of determining importance by the members of the Chemical Mission which recently visited Germany.

It is essential that the British chemical industry should employ a far larger number of the best type of chemist in the future, and that it should attract them by offering adequate prospects. The scientifically trained chemist must be given a far higher status. The popular idea that chemical industry is based on secrets is a fallacy, rather does it depend on direction from men of high practical scientific ability combined with business acumen. Personality on the board can overcome many difficulties in matters connected with site, plant and buildings, whereas even an ideal plant will not compensate for bad leadership. At the moment really qualified men are in short supply, but there is no fear that our universities will not be able to give the requisite training provided they receive adequate support from the industry.

The engineer is by no means an unimportant factor in chemical industry, for in addition to the ordinary problems of work, construction and maintenance, there are the special tasks of each section of the industry. Standard types of plant have been out of the question owing to the diversity of operations in the smaller works, and almost every piece of apparatus has to be specially designed. Unfortunately, but largely in consequence of these facts, makers of chemical plant are re-

latively few so that much of the plant has to be made on the works. In the future, standardisation of all types of vessel should be much more common, particularly as the influence of the engineer extends, and it should then be possible to get better delivery of standard vessels at a more reasonable cost. Opinions are divided as to whether success is better obtained by the co-operation of the chemist and the engineer proper, or by the aid of the so-called chemical engineer who professes knowledge of both crafts; but in any case it will be generally admitted that much more engineering is required in chemical industry at present, and that still more will be necessary in the future. The performance of reactions under pressure and at high temperature, the dealing with large volumes of gases, to say nothing of the more general problems of mechanical handling, all require specialised knowledge of Engineering. It behoves us, therefore, to see that the engineer as well as the chemist is trained for our needs.

At the present time Labour is perhaps the greatest problem in chemical, as indeed in all, industry, and its attitude constitutes the greacst menace to success. Its demands are largely political and governed neither by reason nor by economic facts. Higher wages, shorter hours, and less work, all tend to increase the cost of production to an extent which sooner or later must stop buying in our home markets, as it is already doing in our export markets, and the worker will, apparently, only accept economic facts when he sees ruin at his door. Unless production *per capita* is increased, higher wages can only mean higher prices. The labour problem presses unduly heavily on the chemical trade in which so many of the processes are continuous and the work arduous as compared with the light repetition work in some other national industries. Fortunately the handling of these problems is in experienced and capable hands, and our trade has long been one of the most progressive in its treatment of the workpeople.

It is probable that much good will result from the increased education of the worker provided this is undertaken by the industry itself. At present the chemical process worker is classified as semi-skilled, a few months' training serving to fit the intelligent labourer to do what is required in almost any process. Probably, if pains were taken to give the worker a clear understanding of the general principles of the process, and this were followed by all-round experience in the plant, he would be in a position to earn higher wages, and the firm would benefit by continuity of output, a diminished repair bill and higher yields. There is a fundamental difference between the work performed by the chemical process worker and that done by men engaged on operations connected with machines and mass production, such as those in the engineering industries which have brought about specialisation on the one hand and monotonous repetition on the other. The chemical process worker's duties are considerably varied according to the vagaries of his process, and there is every scope for that intelligence which it is the duty of the industry to develop.

The coal problem is intimately bound up with the welfare of chemical industry, and we are undoubtedly wasteful in our use of this fuel. Apart from its scarcity, which, it is to be hoped, is only a passing phase, the steady deterioration in the quality of our coal is a serious handicap, the magnitude of which probably only the technical man can realise. Furnace work in particular is being adversely affected, and the disposal of the large amount of ashes helps to increase working costs.

The possession of a modern, thoroughly equipped plant is both the ideal of every process manager and the main factor in cheap production, though difficult to obtain without great expenditure of capital on account of the rapid invention of new processes in our industry. Unfortunately the very large chemical factories, such as those at Gretna, Queensferry, etc., which were built by the State, regardless of cost, during the war, are almost without exception situated far away from existing private factories and on sites which are considered to be entirely unsuitable for industrial operations. As a consequence they are of no value during the reconstruction period, whereas had they been constructed as additions to some of the existing chemical works, the industry would have benefited enormously, and the State would have recovered its capital outlay. We shall bitterly regret the policy which has brought about this state of things during the next few years, the more so since it has now been established that the reverse policy has been followed by our chief rivals. The war plants constructed in the Rhine district are no hastily erected structures of a temporary nature, but solidly built and perfectly designed additions to established works, a circumstance which places them in a unique position as regards manufacturing potentialities.

No one would question for a moment the great and successful work done by those entrusted with the task of supplying explosives or the urgency of their task, or indeed, the wisdom of carrying out some of their manufactures in these places, but a somewhat more helpful policy towards the chemical manufacturer would have put our industry on a very much stronger basis.

The position of chemical industry in its relation to peace and war has formed the subject of many recent addresses, but it is desirable once more to emphasise that peace-time factories must be so equipped that they can be at once adapted for the production of warlike materials; plant, trained chemists and workpeople must all be available and ready for mobilisation, and never again have to be improvised after the declaration of war.

A problem second only to that of labour in its importance is that of the transportation both of corrosive chemicals and of bulky materials which will not bear high charges. The war has left British transport in a state of chaos, which constitutes to-day probably the greatest impediment to the restoration of trade; in addition a serious increase in charges is now threatened. Manufacturers must combine through their trade association to assure equitable and intelligent treatment of the specially rated chemicals by the carriers, and must avoid unnecessary carriage on materials in course of manufacture. The State must see that nothing is left undone to render our railways efficient.

It was perhaps typical of British individuality that before the war there was no successful trade organisation of chemical firms. Fortunately this has now been rectified, and the formation of the Association of British Chemical Manufacturers is undoubtedly the most important step the trade has taken of recent years. The process of organisation and consolidation of such an association is necessarily slow, but the A.B.C.M. has already done excellent work in a variety of directions, and occupies an influential position in relation to the Government. In addition to investigating the varied commercial problems which confront the trade, it may be expected in the near future to take a prominent part in the study of some of the more technical problems outlined in this address; it undoubtedly deserves the active support of every chemical manufacturer.

In the foregoing an attempt has been made to indicate some of the essential conditions of success in the chemical industry, which, it must be emphasised, is a *technical industry*. That this

country is capable of winning success there can be no doubt, and the achievements of many branches of the industry seem to endorse this belief. On the other hand there are many lessons to be learned, and it is to be feared that some of these have been overlooked in the recent period of too facile progress when our own markets were closed to outsiders, and we had only to fear American competition, then in its infancy, in the markets overseas.

The outlook is perhaps best described as full of promise, but it needs the wholehearted and intelligent co-operation of all engaged in it if British chemical industry is to occupy the proud place we claim for it. Above all, we must seek the goal made strong by technical excellence rather than by political protection.

THE THEORY OF THE FLOTATION METHODS OF MINERAL SEPARATION.

R. S. WILLOWS.

A paper with the above title was read at the Institute of Mining and Metallurgy on November 20 by Mr. H. L. Sulman, who is to be congratulated on its far-reaching interest and importance. It will probably come as a surprise to many "practical" men to find that the forces at work in a soap bubble are of such technical importance that 60,000,000 tons of ore is now treated annually by the processes described by the author; and as to physicists, the present writer cannot say that he knows more than two who are aware that their science has such useful technical applications. At all events, the paper should forward the education of both practician and theorist, and to that end it is to be hoped that the author will bring his unpublished physical results before one of the societies concerned with physics.

The method of separating sulphide ores from quartz, as practised by Minerals Separation Ltd., consists, briefly, in crushing the material to a fine powder, mixing one ton of this with 4—5 tons of water containing from 0·5—2 lb. of amyl alcohol, cresol, or other suitable liquid which renders the water capable of frothing, and finally blowing air through the mass. The ore is then found to be concentrated in the froth, while the finely-divided quartz remains either suspended in the liquid or sinks to the bottom of the tank. The remainder of the details is not essential to a consideration of the theoretical points involved.

The method is analysed by the author into the three following essentials:—(*a*) A "froth producer," such as amyl alcohol or cresol, which, by reducing the surface-tension of the water, permits the formation of an extensive froth in which the particles become attached. (*b*) A "froth stabiliser," usually a minute amount of an insoluble oil, which being adsorbed at the surface of the mineral, renders the froth more stable, in a manner to be described. (*c*) A "gangue modifier" (mineral acid, alkali, salts, or sols), which renders the gangue particles more easily wetted by water and so prevents their rise into the froth.

The function of the froth producer is, of course, clear. The production of a large froth surface entails the creation of correspondingly large amounts of surface energy. The larger this energy is per unit area, the more unstable the froth becomes, according to the principle that every system will change, if given the opportunity, in such a way as to reduce its potential energy. Thus water containing cresol, having less surface energy than the pure liquid, produces a lasting froth more readily. But the cresol has a further important effect. A film of pure liquid, when thinned by drainage or stretching, soon breaks, because the surface tension cannot accommodate itself to the stresses which vary from point to point. The cresol, since it lowers the surface tension of water, concentrates itself to some extent where it can do this most effectively, *i.e.*, in the surface, in accordance with the principle just noted. When the film is stretched, at first more cresol passes from the interior into the new surface, but the limit of this passage being reached, any further stretching produces a surface containing less of the impurity and having a greater tension; hence further extension is resisted. By this means the area of the film can undergo considerable variations without rupturing. From this point of view, the designation "froth-producer" is not the best, as the most important function of the cresol is to act as a "froth stabiliser."

Retaining the author's nomenclature, the action of the "froth stabiliser" is most interesting physically, and the work on angles of contact deserves the serious consideration of physicists. With soap, tannic acid, etc., it is possible to get a large reduction of surface energy and much froth, which is nevertheless barren of ore. What is needed is a substance which yields a stable film, but does not reduce the surface energy to such an extent as to displace the mineral from the film. A partially soluble liquid like cresol may act both as "froth producer" and "froth stabiliser" (author's nomenclature). Its effect in the latter capacity appears to be to give a wide range of angle of contact of ore liquid, which is found necessary for flotation. A number of measurements given in the paper shows this effect, and demonstrates also that when a plane surface of the mineral is turned in the surface the angle of contact does not immediately follow the change; there is, in fact, hysteresis. From its mode of action, "contact modifier" appears to be a better term for the added substance than that of "film stabiliser" used by the author.

The next step in the process is to ensure that the gangue is not floated. This is the function of the "gangue modifier," which causes the unwanted particles to be thoroughly wetted and so prevents their entrance into the froth.

The paper reminds one of Pickering's experiments on emulsifying a petroleum oil in water with the help of a solid emulsifier like soot. Also of Clowes' work on oil-water emulsions, in which the disperse phase can be made oil or water at will by the addition of caustic soda or calcium chloride, respectively.

Most physicists and colloid chemists will be inclined to question much of the author's theory, but a just criticism is not possible at this stage, as some of the evidence on which his conclusions are based is not included in the paper. Thus, unlike the text-books, he is clear that zero angle of contact does not necessarily mean complete wetting—complete wetting only occurring when the interfacial energy is zero—but he too readily assumes, or takes as proved, that complete wetting has taken place in the examples he deals with. In this connexion, it may be asked, Does water at 0° C., or just above that temperature, wet ice completely? And how can it be proved? It is known that electro-endosmose occurs with water in an ice tube. Is not this proof that there is energy residing at the ice-water interface which is to be called surface energy? Hence, contrary to the author's opinion, a sol has surface energy.

The author's view that wetting is frequently followed by penetration of the liquid into the solid is well supported by McBain and his co-workers and by Marc, who find that adsorption is followed by solid solution.

It is suggested that a solid in sol form is completely wetted, that, in fact, this is a condition of peptisation, neglecting electrical and valency effects altogether. It must be admitted that the theory of these is very far from complete, yet it is difficult to explain Bredig's method of sol formation—by means of an arc or spark—on such a theory as the author's. Smoluchowski's theory of precipitation, which has received very definite experimental support, and the work of Langmuir and Harkins on liquid films will also have to be taken into account. In addition, questions such as the following will require an answer: If neither of two oppositely charged sols possesses surface energy, how it it that they precipitate each other when suitably mixed? The coagulation must cause an energy decrease. Where is this located?

Work of Edser is mentioned which is said to prove that air is not adsorbed on certain solids, of which quartz is one. Langmuir finds a small but definite adsorption for mica and glass, which increases as the pressure is raised from a fraction of a mm. of mercury.

Space prevents further detailed examination, but sufficient has been said to show that the paper is well worthy of perusal, alike by the mining metallurgist and the pure physicist.

MUSTARD GAS MANUFACTURE.

J. WILLIAMS.

The recent controversy between Sir William Pope and Messrs. Levinstein on the question of "mustard gas" manufacture stands in need of elucidation, as it leaves the impression that the former was entirely responsible for the research work and the latter for its manufacture.

The history of mustard gas up to May, 1918, appears to be shrouded in mystery, as little was known of what was being done towards its production on a scale that would be of value to the Higher Command in France. The writer can, however, detail its history from May, 1918, when its manufacture was taken over by the Department of Explosives Supply.

On that date H.M. Factory, Avonmouth, was asked to take up the manufacture of the gas. No reliable information was given except that it could be produced from ethylene and sulphur chloride. An experimental plant consisting of various types of ethylene generators and reaction vessels was erected in the short period of six weeks and was in commission from June 15 to July 16. Although this plant only produced twelve tons of gas, and this of variable quality, it had served its purpose in that it supplied valuable information and experience required for running a large scale plant. On the information gained, three sulphonators which were on the site were quickly converted into reaction vessels, by means of which over 100 tons of gas was produced during the 27 days they were in action.

Meanwhile, the construction of the permanent plant was proceeding apace, and on September 12 it was put into operation. The total output from this up to the time of the armistice was 500 tons, and plant was being put into operation on that day to produce 40 tons per day, while two weeks later the output would have been 70 tons per day. Actual production figures are recorded at the D.E.S. and the plant now at Avonmouth is convincing proof of the estimated output.

I must admit that the chief obstacle to increased output at Avonmouth was sulphur deposition, but at the same time I should like to point out that low temperature alone is not sufficient to prevent the separation of sulphur, as Messrs. Levinstein discovered when they attempted large-scale manufacture. There are other critical factors, such as degree of agitation and ethylene supply, for it is essential that the reaction between the ethylene and sulphur monochloride be completed in the minimum of time.

On a small scale plant producing only about a ton a day such as Messrs. Levinstein had at Blackley, the conditions are quite favourable for the retention of the sulphur. At Avonmouth the staff concentrated its attention on maximum output throughout the production period. Elimination of sulphur deposition, however, was not overlooked, and measures were about to be introduced which would have overcome this trouble decisively.

NEWS FROM THE SECTIONS.

EDINBURGH.

At the meeting held on November 18 at Edinburgh, Dr. D. S. Jerdan presiding, Mr. F. S. Merrils read a paper on "The Measurement of High Temperatures." In dealing with this subject only instruments used industrially were described. The principles underlying the use of thermo-electric pyrometers were discussed and slides of diagrams and instruments were shown to illustrate their working. Photographs of two installations at Messrs. Brunton's Research Laboratory with their complicated wiring were shown, illustrating how any number of thermo-couples can be taken to a central indicator and the temperature recorded on a chart by means of a clockwork mechanism. A short account of the relation between radiant energy and temperature was given as an introduction to the subject of radiation pyrometers. These instruments are of especial value in the reading of very high temperatures such as obtain in the electric arc. The general principles of optical pyrometers were then explained, and an instrument was exhibited.

NEWCASTLE.

The Newcastle Section held its last meeting on November 19 in Armstrong College. Prof. P. P. Bedson was in the chair.

The Section unanimously and heartily passed a resolution inviting the Council to hold the annual meeting for 1920 in Newcastle. (The invitation has since been accepted.)

Mr. S. H. Collins then read a paper on behalf of the author, Mr. N. N. Sengupta, on "A Study of the Fruit of *Schleichera Trijuga*, with special reference to the Generation of Hydrocyanic Acid in the Seed." The paper, which proved to be a valuable contribution to our knowledge of this little known subject, was divided into three parts:—(1) A general survey of the constituents of the various parts of the fruit from the standpoint of nutrition; (2) a study of the cyanogenesis in the seed; and (3) examination of the fat. From a utilitarian point of view, probably the most important aspect dealt with was the suggested methods whereby the potentially dangerous press cake could be rendered harmless and innocuous for cattle feeding purposes. Provided that this could be done with certainty, the press cake should prove a very valuable feeding stuff on account of the high percentage of albuminoids which it contains.

On November 22, some fifty members of the Section were shown round the works of the Newcastle and Gateshead Co., Elswick, Newcastle, and were subsequently entertained by the company.

GLASGOW.

The first meeting of the session was held in the North British Hotel, Glasgow, on November 28, with Mr. Quintin Moore in the chair. A paper on "A Visit to the Rhineland Chemical Works" was read by Mr. D. A. Bost, who described the visit to German chemical works made by the mission representing the Association of British Chemical Manufacturers. A total of 39 factories was visited.

The author's paper dealt principally with the Leverkusen works of Fr. Bayer (see this J., 1919, 285 R), and mentioned, among other points, that most of the buildings are of brick, about 40 ft. high, and without regular floors, so that plant can be erected to this height in any suitable place; ferro-concrete is not used because such permanent constructional material might interfere with changes in plant. The status of the chemist was also considered, and the success of German chemical industry ascribed to, cheap raw materials, cheap power, and cheap carriage; discipline among the process workers; the business capacity of the chemists; the co-operation of engineers and chemists; and the willingness of the manufacturer to spend money because he had faith in the ultimate results.

In the discussion, Prof. Heilbron referred to the influence of the German universities on research and the support they received from manufacturers; Prof. Wilson discussed the inter-relationships of universities, technical colleges, industry and the State; and Prof. Desch expressed the opinions that the German chemist was not superior to the British, and that the success of German chemical industry was not due to fiscal policy or State support.

LONDON.

An ordinary meeting was held at the Chemical Society's Rooms, Burlington House, on December 1. The chairman, Mr. Julian L. Baker, stated that an opportunity was afforded those wishing to sign a petition in favour of extending the hours of opening of the Patent Office Library to 10 p.m., in conformity with the practice obtaining before the war.

A paper entitled "Ethyl Chloride" was then read by Mr. A. Henning, describing its use as an ethylating agent in the synthesis of dyestuffs and drugs, as a refrigerant, and as a solvent. Large quantities of ethyl chloride were made in Germany prior to the war, the annual output of a single factory in that country amounting to 250,000 kilo.; America has now four factories devoted to its production, and there is also one in Canada and another in Australia As an ethylating agent it is very much cheaper than the more generally used sulphate, the approximate cost per lb. of the ethyl radical C_2H_5 being 2s. 3d. in the case of ethyl chloride, as against 12s. for the sulphate. There appears to be a widespread illusion that it is necessary to store ethyl chloride in high-pressure cylinders, and that it is, consequently, a dangerous and inconvenient reagent, but it can be stored quite simply in ordinary drums and can even be syphoned or poured in jugs from one vessel to another; it suffers no loss when kept in corked bottles, and it only evaporates slowly when exposed to the atmosphere Although inflammable it is no more dangerous than alcohol, and it is not possible to ignite it by means of sparks. Tables were shown giving the physical properties of ethyl chloride, and also typical transformations effected by its use in the dye and intermediate industry, in which it is of great value. Types of autoclaves used in ethylating were shown, but for these it is important that no grease be used in the joints, a packing composed of fibre and glycerin forming an efficient substitute. It should also be remembered that the pure material should be employed since traces of the methyl radical cause variations in the shades of colours obtained. A great advantage possessed by ethyl chloride is that it does not become the least acid on prolonged storage, and this greatly enhances its usefulness as a solvent in the works or laboratory. Coming to its use as a refrigerant, the lecturer showed tables of its thermal properties, and stated that there were 150 plants in the United States at present employing it instead of ammonia or carbonic acid. Since it does not act upon metals, a direct circulation variety of refrigerating plant can be used. For laboratory use ethyl chloride is supplied in convenient holders, syphons or small containers, and when ice is unobtainable it is very useful for obtaining low temperatures. Allusion was also made to its value as an insecticide.

The next paper was by Mr. C. E. Barrs on "The Influence of Impurities in Lead when it is heated with concentrated Sulphuric Acid." It is well known that the lead employed in lead chambers of sulphuric acid plants is more or less liable to attack, such action being associated with the chemical composition of the metal employed. In a particular case a lead which contained 0·002 per cent. of copper was attacked at 250° C., whereas another sample which successfully withstood the action of the strong acid up to 296° C. was found to contain 0·021 per cent. A table was shown which indicated the temperatures at which (1) initial action and (2) vigorous action commenced when different metals were subjected to the action of strong sulphuric acid, and evidence was adduced that the most satisfactory percentages of copper as regards increasing the resistance of lead to the action of hot acid lay between 0·002 and 0·05, such lead being able to withstand corrosion up to 280° C. In the discussion which followed, Mr. Lancaster stated that a really pure lead quite free from copper will withstand the action of strong sulphuric acid up to a temperature of 300—310° C. Lead made by the Pattinson process usually contains more copper than that obtained by the Parkes' process, and is consequently more in demand for lead chamber work; it is, however, impracticable to use more than 0·2 per cent. of copper in lead used for sulphuric acid chambers.

MANCHESTER.

The annual dinner of the Section will be held at the Grand Hotel, Manchester, on January 22 next, at 7 p.m. The President, Mr. John Gray, has accepted the invitation to be present, and during the evening Mr. L. E. Vlies, the former Hon. Sec., will be presented with an illuminated address in recognition of his services. Tickets (8s. 6d.) may be obtained from the Hon. Sec., Mr. Guy Radcliffe.

The Committee of the Section has decided to issue an up-to-date edition of the Handbook early in January, 1920, and local members are asked to furnish the Hon. Sec. with the necessary particulars immediately.

MEETINGS OF OTHER SOCIETIES.

SOCIETY OF GLASS TECHNOLOGY.

The November meeting was held on November 19, in the Applied Science Department of the University of Sheffield. In the absence of the president, Dr. M. W. Travers took the chair.

The first paper was entitled "The Reversible Expansion of Refractory Materials," by Mr. H. J. Hodsman and Prof. J. W. Cobb, and was read by the latter.

Silica refractories on firing have a permanent

expansion, whilst fireclay refractories have a permanent contraction. On subsequent heat treatment both types undergo expansion which is reversible on cooling. The paper dealt with this reversible expansion. The authors briefly expounded methods of measuring expansion at high temperatures and described in full the methods actually employed by them. The range of temperatures through which reversible expansion had been investigated was 15°—1000° C., and some very remarkable results had been obtained. It was shown that alumina and kaolin expanded regularly within the above temperature range. Silica, whilst having approximately the same mean expansion between 15° and 1000° C., behaved very differently at intermediate temperatures. Thus between 15° and 1000° C. it expanded regularly at a rate slightly greater than that for kaolin. Between 500° and 600° its mean coefficient of expansion was much greater, whilst between 600° and 1000° C. its expansion was practically nil. The anomalous behaviour between 500° and 600° C. was probably due to a change from α quartz to β quartz. There was nothing in the results to indicate the formation of tridymite between 600° and 1000° C. A mixture of ganister and clay (4:1) behaved like silica. Fireclay and pot-clay behaved similarly to silica, the behaviour being nearer that of silica than that of kaolin. Ball clay, alundum, and carborundum behaved similarly to kaolin. In conclusion, the authors discussed the bearing of the results upon the arching and subsequent heating of glasshouse pots and other refractories.

The second paper was on "A Proposed Standard Formula for a Glass for Lamp Workers," by Messrs. F. W. and F. H. Branson. After reviewing their early work on pre-war tubing for lampworkers, the authors gave an analysis of the tubing they considered most suitable for this purpose, together with the composition of a batch for its production. The tubing was found to be satisfactory in every way. It could be reblown many times without devitrification, and was especially suitable for making plugs, stopcocks, and bulbs. It joined easily with all the best British-made glasses, including the resistant varieties, and was quite suitable for the repair of pre-war imported chemical glassware. The glass was quite free from appreciable colour, and did not darken in the blow-pipe flame.

ROYAL SOCIETY OF ARTS.

The opening meeting of the 166th session was held on November 19, when Sir H. Trueman Wood delivered the Chairman's Address on "Science and Industry." An interesting sketch of the industrial conditions obtaining a century ago formed the prelude to the admonition that all our progress has been accomplished by individual effort; in those days State organisation and control always acted as a brake to the wheels of progress, but to-day public opinion tends to run to the other extreme. After all, it is the nature of man to oscillate like a pendulum; yet, although the latter makes no advance, the clock goes steadily on. The development of industries based essentially on scientific discoveries was then considered, and the relative merits and demerits of German contributions thereto discussed. The lecturer does not hold the view that British manufacturers have ignored science—witness the development of engineering and of the "heavy" chemical industry—but they have been far too slow in grasping new ideas and in risking capital on costly researches. The launching of the Department for Scientific and Industrial Research was an experiment well worth the making, and, in any case, it should prove of great value to many of our smaller industries. The remainder of the address dealt with the provision of new sources of power and with the part played by the Society in promoting industrial progress.

On November 26 Mr. B. Brenan, late H.B.M. Consul-General at Shanghai, China, contributed an instructive statistical paper on "British Trade in China," in which he sketched the foreign trade of China from early in the sixteenth century down to recent times. Towards the end of his address the author stated that Japan now holds a very strong position in the Chinese market, and that it will require very great effort on our part to recover what we have lost during the war. Close corporations, exclusive dealings, trade secrets are things of the past; co-operation, amalgamation, alliance are the watchwords of the future. The very leisurely manner in which the British Government foreign trade reports are issued was criticised and contrasted with the expeditious and up-to-date reports of the American Government. The commercial attaché should not be chosen from the ranks of business men; he must be essentially a diplomatist, by instinct or training. The Chinese as a people are naturally inclined towards the English, and this tendency should be fostered by affording facilities to Chinese students to pursue their studies in this country. In the past England has always maintained her foreign markets—if she has lost one she has gained another—thanks largely to cheap coal and cheap raw materials. At the present time the chief danger is in respect of the latter. Lastly, in trading with China it must be borne in mind that the right kind of advertising pays, that it is hopeless to try to eliminate the Chinese middleman, and that up-to-date methods alone lead to success.

A course of three Cantor Lectures is being delivered by Prof. J. T. Hewitt on "Synthetic Drugs."

SOCIETY OF PUBLIC ANALYSTS.

Two papers were presented at the meeting held on December 3, under the chairmanship of Dr. S. Rideal. Mr. G. van B. Gilmour described "A New Distillation Method for Detecting Adulteration in Butter and for Estimating Fats of the Coconut Group," which consists in separating the volatile acids into two groups depending on their solubility or insolubility in saturated brine. Results were given for the application of the method to the distillate from the Blichfeldt apparatus, indicating that the composition of a fatty mixture deduced in this manner is more reliable and more rapidly obtained than by the combination of the Reichert-Meissl and Polenske-Kirschner methods.

The second paper, entitled "A New Process for the Determination of Arsenic; with Notes on the Chemistry of the Marsh-Berzelius Process," was read by Mr. B. S. Evans. Arseniuretted hydrogen, evolved by reduction with zinc and sulphuric acid, is decomposed by passing it over ignited copper, and the increase of weight of the latter is determined. Heavy metals must be absent. The retention of arsenic in the Marsh-Berzelius test is ascribed to the formation of metallic arsenide and elemental arsenic.

THE CHEMICAL SOCIETY.

Sir J. J. Dobbie, in presiding at the meeting held on December 4, invited signatures to the petition addressed to the President of the Board of Trade in favour of extending the hours of availability of the Patent Office library to 10 p.m. daily, as was the practice from 1888 to 1914.

Dr. T. M. Lowry presented two communications. In the first, "The Separation of Minerals by Decrepitation," he showed how barytes could be separated from galena and blende in a mixed ore occurring at Keswick by heating the mineral to

about 300° C., and then eliminating the unaltered lumps of sulphide and rock by passing through sieves. Experiments on similar ores showed that the barytes was separable by this method in about 50 per cent. of the ores examined. In the discussion the point was raised as to whether decrepitation was due to the expulsion of moisture, or if it was the outcome of unequal expansion or of unequal thermal conductivity along different directions in the crystals. Although there was some presumptive evidence in favour of the latter view, the fact that in the author's experience decrepitation is always accompanied by loss of water shows that the time-honoured explanation cannot be disregarded.

In his second note, "On the Decomposition of Nitric Esters by Lime," Dr. Lowry referred to the work of Prof. W. R. Hodgkinson on the decomposition of cordite with slaked lime and water in presence of pyridine, and then discussed the chemical composition of the products so obtained and their value for manurial purposes. Lieut. K. C. Browning, assisted by Mr. J. W. Farmery, had investigated the products of decomposition and found among them chalk, calcium oxalate, calcium nitrate and nitrite, traces of calcium acetate and formate, and the calcium salts of hydroxypyruvic and dihydroxybutyric acids. Except in one case, when 40 per cent. of pyridine had been used instead of 0·5—5 per cent., no glycerol was detected. Pot-culture tests at Rothamsted showed that the product, which contains about 6 per cent. of combined nitrogen, was in some instances detrimental to plant life, especially during the earlier stages of the decomposition, and further investigation showed that this toxic action was invariably due to calcium hydroxypyruvate. An interesting discussion ensued on the mechanism of the "hydrolysis" of nitroglycerin. The author holds the view, based upon a suggestion first made by Berthelot, that when trinitroglycerol is decomposed by alkalis it yields directly an alkali nitrite and a carbonyl compound, dialdehydeketone, CHO.CO.CHO, which by addition of water forms hydroxypyruvic acid, $CH_2OH.CO.COOH$, as against the alternate hypothesis that the primary products of decomposition are glycerol and nitric acid or a nitrate, and that the nitric acid, in a peculiar or "nascent" form, oxidises the glycerol and becomes reduced to a nitrite.

PERSONALIA.

We regret to record the death of Dr. J. Grossman, an original member of this Society, at Manchester, on November 28 last.

Mr. Alexander Richardson, A.R.S.M., has been appointed Principal of the Cornwall School of Metalliferous Mining.

Dr. J. E. Stead has been nominated President of the Iron and Steel Institute for 1920, in succession to M. Eugène Schneider.

Professor T. W. Richards, who holds the chair of chemistry at Harvard University, has been elected a foreign member of the Royal Society of London.

The impending retirement is announced of Mr. E. Wyndham Hulme, chief librarian at the Patent Office, and of Mr. R. Harrison, assistant secretary of the Royal Society.

Dr. Charles L. Parsons has resigned his appointment of Chief Chemist to the Bureau of Mines, Washington, in order to give more time to his duties as Secretary of the American Chemical Society.

NEWS AND NOTES.

CANADA.

Developments in the Sydney District, Nova Scotia.—Much activity has been shown of late by the steel and coal companies of this district, and a large scheme of extension, involving the erection of a new plate mill and coke ovens, has been carried out. In former times many wooden ships were built in this district, and it is now the ambition of these companies to revive the industry and make the province of Nova Scotia into a shipbuilding centre of the first magnitude.

During the past year, well over one million dollars has been expended on the iron mines and quarries in Newfoundland, from which the steel companies derive their ore. The programme calls for construction work at Sydney plants on a large scale, and the marketing of Wabana, Newfoundland, iron ore in foreign markets. The coal areas are being further developed, and, while the St. Lawrence market has been lost, extensions in other directions have counteracted this loss. The removal of the large coal fleet, which once ran between North Sydney and Montreal, may gradually be restored. Working conditions in the Cape Breton coal districts are better than they ever were previously, more electrical equipment is being installed and operations on new seams are being projected.

BRITISH INDIA.

Industrial Progress.—During the present year there has been an unprecedented boom in the flotation of industrial companies, as was perhaps inevitable. The general industrial development of India is decidedly backward, as many manufactures have been imported which could quite well have been produced in the country. The policy of the Government tended to discourage the introduction of Western industries, as it involved the purchase of nearly all requirements in London through the India Store Depôt, including products which were available in India, such as linseed oil and cotton waste. As the Indian Governments are comparatively large buyers, this had a considerable influence, but even before the war the policy was undergoing modification. The difficulty of obtaining goods from Europe accelerated the change, and in 1916 the Indian Industrial Commission was appointed with Sir Thomas Holland as president. In the following year he was also made president of the Munitions Board, which did much to organise the resources of the country and render them available for the prosecution of the war in Mesopotamia, East Africa, and Palestine. Sir T. Holland is at present in England in connexion with the formation of a separate Department of Industries under the Government of India, but he is expected to return soon to prosecute the matter here.

These developments and the large profits made by practically all industrial undertakings during the war caused the flotation of a large number of new companies, the shares of which were subscribed for very freely, but it is to be feared that many of the new firms have but little prospect of making profits, especially as some of the promoters and directors have no experience of work of this sort. There are, moreover, special reasons which tend to neutralise the advantages of the present time. In consequence of the failure of the crops last year the prices of the ordinary foodstuffs are about twice as high as usual, and it has been necessary to raise wages accordingly. The rupee also has risen to 1½ times its previous value as expressed in gold currency, the effect of which is not only to render competition

with imported goods more difficult but also to cause many people to send their money out of the country. The boom is already falling off in strength. At the same time, there is really plenty of money in India for the erection of factories, etc., if it could only be rendered available, for every year gold and silver in coin or bullion are absorbed to the value of about £30,000,000. Some of this is made into jewellery, but a very large proportion is simply hoarded.

The new ventures include a number that are to work various chemical industries. Pharmaceutical products will be manufactured on a considerably larger scale than previously, and Indian skins and hides will be tanned here with Indian tanning materials instead of being exported whilst large quantities of leather are imported. Undoubtedly there is a great field for chemical industries which will work up the abundant native raw materials.

Proposed Sugar Cultivation in Ceylon.—A special Sugar Committee of the Ceylon Agricultural Society has presented a report recommending the establishment of sugar cultivation on the island. It is considered that the success of the proposal depends entirely upon the amount of assistance the Government will give. It is generally admitted that there are immense possibilities in the way of sugar cultivation, either from the palmyra palm or from the cane, but private enterprise has lost heavily in the past, and therefore there is a desire for Government support by means of land concessions, cheap loans, and experimental mills.—(*Bd. of Trade J.*, *Nov.* 20, 1919.)

AUSTRALIA.

The Prickly Pear.—This plant has become a serious pest in many parts of Australia, and numerous methods have been suggested for its eradication and possible utilisation. Prickly pears belong to the cactus family and are indigenous to America, but several species have become acclimatised in Queensland and New South Wales. Chief among these is the pest pear, *Opuntia inermis*, which covers about 22 million acres in these States and is spreading at the rate of a million acres per annum.

Utilisation.—As a reserve food for cattle in case of drought it appears to have considerable value, but it is not a well-balanced food and needs mixing with other fodder. In Ceylon, India and South Africa, prickly pear has been used as a green manure, but it is necessary to bury the broken parts in wide trenches under about 18 in. of soil.

The fruits have been used for the manufacture of alcohol in Spain and Sicily, but the operations were not a commercial success owing, it is stated, to the heavy excise duty. Investigations made in the United States showed that 140 lb. of the fruit was required to produce one gallon of alcohol, and that in order to make the operation a commercial success it would be necessary that (1) a production of 10 tons of fruit per acre be obtained, (2) a rapid and cheap method of collection be introduced, as hand gathering is too dear even with cheap labour. In view of these facts, it does not seem possible that this method of utilising the fruit would prove remunerative in Australia.

Attempts have also been made to produce alcohol from the green parts of the plant, but even under the most favourable conditions the yield is only 0·5 per cent. of the material treated.

The utilisation of prickly pear as a paper-making material has been tried both in the United Kingdom and in Australia, but the results are not promising owing to the small yield of pulp and the shortness and poor felting quality of the fibres.

The ash of the pest pear, which amounts to about 10 per cent. of the dried plant, contains about half its weight of potash salts, and it has been suggested as a possible source of potash for local use. Large scale experiments have been made in Australia, but in view of the difficulty in collecting the material and the fact that the ash is practically certain to be contaminated with soil, it does not seem likely that the product obtained would repay the cost of treatment.

Eradication.—Once the prickly pear has become established, its removal by ordinary mechanical means is almost impossible. The most successful means so far used has been that of poisoning by means of arsenic compounds. Arsenic pentoxide is the most effective of these, about half a gallon of a 2·5 per cent. solution being sprayed on each cwt. of plant. If an atomiser spray be used, then about 1 oz. of a 25 per cent. solution is employed. Arsenic pentoxide was almost unprocurable in Australia during the war, but it is understood that the Queensland Government intends to manufacture this chemical. Arsenic chloride, heated and used in an atomised spray, has proved very effective for dealing with dense, impenetrable masses of prickly pear. It is being manufactured for this purpose by a firm in Melbourne.

Arsenite of soda or a mixture of arsenic trioxide, caustic soda and common salt, is less efficacious than either of the above-mentioned compounds, and has the disadvantage of requiring large quantities of water, which is frequently very scarce in the infested districts. It is, however, less dangerous to use and cheaper. The cost of eradication by the three above means varies from £2 10s. to £4 per acre, and although this expenditure would be worth while for clearing valuable agricultural land, it would not be profitable on poor scrub.

In certain parts of India and Ceylon the cochineal insect has almost exterminated the tree pear (*Opuntia monacantha*), and experiments in Australia have indicated that the insects will rapidly spread and soon exterminate a large area of the plants. The tree pear, however, is not a serious pest, and the insects refuse to attack any other species. A travelling commission, appointed by the Queensland Government to investigate the natural enemies of the prickly pear, recommended the introduction of certain insects and fungi as a means of eradication. A sum of £2,000 has been placed at the service of the Advisory Council by the Minister of Agriculture for New South Wales for the purpose of further research work in the State, and it seems probable that a similar sum will be allocated by the Government of Queensland.

The Executive Committee of the Advisory Council therefore recommends the establishment of one central and two subsidiary laboratories for studying the effect of insects and fungi on the prickly pear. The central laboratory is to be under the direction of a biologist, who will receive £1,200 per annum, whilst the subsidiary laboratories will be in charge of entomologists at £750 each per annum.—(*Bull.* 12, *Inst. Sc. and Ind.*, *Austral.*, 1919.)

UNITED STATES.

Use of Crystallisers in Cane Sugar Factories.—The economic advantage of employing crystallisers in raw cane sugar factories is being investigated. The data so far collected indicate that a saving of much time and an increase in the yield of sugar may result from the use of such apparatus, thus helping to reduce costs. While crystallisers are in general used by refiners and beet sugar manufacturers, they have been given little attention in making raw cane sugar.

Chemical Warfare.—In a paper on this subject contributed by Maj.-Gen. W. L. Sibert, of the Chemical Warfare Service, to the annual convention of the International Acetylene Association, it is recorded that at the date of the armistice

Germany was making mustard gas at the rate of 10—12 tons a day, and that the American output was then 40 tons, with a daily capacity of 80 tons. Whilst about 30 per cent. of the total casualties in the United States Army was due to gas, only about 3—4 per cent proved fatal, and of the remainder nearly all will recover. A surgeon who had treated 2000 such cases, gassed 4—5 months previously, stated that there were no indications of lung trouble or of any permanent injury. Maj.-Gen. Sibert is of the opinion that as surprise is the essence of success in gas warfare, research connected with it should be conducted in strict secrecy, and in peace time as well as in time of war.

Magnesite in the U.S.A. in 1918.—The crude magnesite produced, sold, or treated in the United States in 1918 amounted to 231,605 short tons, valued at $1,812,601 f.o.b., mines or plants, representing a decrease of about 27 per cent. in quantity and 37 per cent. in value compared with 1917.

There was a decrease of 60 per cent. on the Californian output, but an increase of 40 per cent. on the Washington production. This unexpected change of output in California, after five years of rapidly increasing prosperity, was greatly influenced by the temporary restrictions on shipments of freight, together with an increase in rates. The makers of refractory products insisted on having calcined material, because its use would save 50 per cent. in weight and freight charges, and the prices offered to small producers were so low that many had to discontinue operations.

A vital factor is that the principal markets are 2000 to 2500 miles away from the deposits. It is possible, now that the war is over, that European magnesite may soon be delivered at New York. Should the price of the imported material be even double its pre-war price, it would reduce the United States production to a few thousand tons per annum.

Practically all the magnesite produced in Washington is used for refractory purposes as synthetic (artificially combined) ferro-magnesite. This product is used in basic open-hearth and electric steel furnaces.

It is still an open question whether the amorphous magnesite of California and the crystalline product of Washington are equally suitable for refractory uses, very little evidence being available. The main factors seem to be freight and delivery.—(*U.S. Geol. Survey, Sept.* 16, 1919.)

Fuller's Earth in the U.S.A. in 1918. — Fuller's earth derives its name from its original use in fulling cloth, but only a small quantity, mainly domestic, is now used in the United States for this purpose. It is used principally in bleaching and in clarifying or filtering fats, greases, and oils. It is also used in the manufacture of pigments for printing wallpapers, in detecting certain colouring matters in some food products, as a substitute for talcum powder, and, in medicine, as a poultice and as an antidote for alkaloid poisons. The requirements of a good earth for refining edible oils are that it should bleach the oil permanently, leave no disagreeable taste or smell, have small retentive power of oil, and no tendency towards spontaneous ignition. The English earth is considered to fulfil all these requirements, but the domestic earth usually has one or more failings, although some refiners have used it with success.

The United States product is chiefly used in refining petroleum, and 1918 was a record year in every respect, 97,075 short tons being consumed, or 8 per cent. more than in 1917. The home production amounted to 84,468 short tons (representing 87 per cent. of the total consumption), at an average price of $13.57 per short ton, a value of no less than $1,146,354. Florida was responsible for four-fifths of the total quantity. The total imports were only 12,607 tons of wrought and unwrought earth, fetching an average price of $11.67 and $13.24 per short ton, respectively.—(*U.S. Geol. Survey, Aug.* 27, 1919.)

JAPAN.

The Caffeine Industry.—The manufacture of caffeine from tea dust has been carried on in Japan for about three years. There is one large company in Japan proper, but another company, already making caffeine in Formosa, is to establish a new factory in Shizuoka, Japan; and there are three smaller factories.—(*U.S. Com. Rep., Oct.* 18, 1919.)

GENERAL.

British Dyes.—In his address to the meeting of dye consumers at Manchester on November 28, Lord Moulton, chairman of British Dyestuffs Corporation, Ltd., revealed the interesting fact that he was responsible for the insertion in the Peace Treaty of the clauses which secure for the Allies 50 per cent. of the German dye stocks, as at August, 1919, and the option over 25 per cent. of the total German production during the next five years. The former condition will prevent Germany, the only country possessing stocks of dyes, exercising a monopoly, and the latter will frustrate the favourite German policy of refusing to sell certain "lines" unless the customer buys all his other dyes from the same source. If at the end of five years our dye industry was unable to stand on its own feet, it would not be worthy of further assistance. Of the stocks to be released immediately, Italy, France and Belgium combined are to receive 2200 tons, and America and Great Britain 1500 tons each. Referring to the British Dyestuffs Corporation, the speaker refuted the criticisms that had recently been directed against it, and stated that the country's confidence had been shown by a subscription of £5,000,000. In 1914 the industry was producing only 10 per cent. of the total home demand; by the end of this year it will be able to supply 80 per cent. of the pre-war requirements. At the present time the range of dyes manufactured had perforce to be restricted in order to meet the demand for those of which very large quantities were required. When the necessary plant was available there was no dye of any importance which the Corporation would not be able to supply.

Coke-oven Gas for Town Supply.—In a paper read recently before the Midland Institute of Mechanical, Civil and Mining Engineers details were given of the introduction of coke-oven gas into the town's gas supply of Sheffield (see this J., 1919, 65 R). The coke-oven gas so introduced represents about 10 to 12 per cent. of the total output of the Sheffield Gas Company, equivalent to about 20 to 25 per cent. of the make of gas at the works of the company where it is introduced. The average supply of coke-oven gas over a period of nearly 12 months has amounted to 7,262,860 cub. ft. weekly, of an average calorific value, after extraction of benzol, of 509 B.Th.U. per cub. ft. The supply pressure is 36 in. of water. The coke-oven plant located at the Tinsley Park Colliery consists of 55 Kopper's regenerative ovens, and the gas is conveyed a distance of about 2 miles. The alternative plan of utilising the "surplus" coke-oven gas at the colliery for generating electricity was not considered sufficiently reliable owing to the richness of the gas. The "surplus" gas, which is admixed with the town's gas supply, amounts to about 50 per cent. of that generated in the coke-ovens, and it is anticipated that this figure can be improved by steaming.—(*Times Eng. Supplement, Nov.*, 1919.)

Production of Gas from Wood During the War.—Denmark, Norway, Sweden, and Switzerland in particular, have had recourse to making gas from wood during the war, owing to shortage of coal. The process gives rise to many difficulties when carried on in the present form of retorts, chiefly on account of the acid condensates which are formed during distillation, and which attack pipe-lines, gas-meters, etc. Carbon dioxide may be economically removed by passing over red-hot carbon, and this process also removes the major portion of the acetic acid, the remainder being neutralised by ammonia supplied by a small, measured quantity of coal added to the main charge of wood to the retorts. This method has been used at Stockholm. In Denmark peat and wood were alternately gasified in horizontal retorts, the calorific value of the gas produced being increased by mixing with coal gas. It was found necessary to alter the adjustments of all burners owing to the greater density of the gas, but no difference was noticed in the running of gas engines. Germany also made wood gas in some of the gas works during the war, but only in small quantity.—(*Gas J.*, *Oct.* 21, 1919.)

Use of Natural Steam for Power Production in Tuscany.—The natural steam springs at Larderello, in Tuscany, from the condensed vapour of which boracic acid has for a long time been produced, have now been harnessed to produce power. At a depth of from 195 to 390 feet, dry steam at three atmospheres pressure is obtained, and this is passed at about one atmosphere pressure around the aluminium tubes of a sheet-iron tubular boiler, producing in the tubes clean steam at one-half atmosphere pressure. This steam is then utilised in special turbines to generate electric current at 36,000 volts. The current thus obtained is distributed to Siena, Florence, Leghorn, Piombino, where there are iron and steel works; to Massa, where there are iron and copper pyrites mines; and to other places. So far as the Larderillo district is concerned, the coal problem, which is in Italy very acute, has been solved by the utilisation of this natural steam.—(*U.S. Com. Rep.*, *Oct.* 1, 1919.)

Molybdenum Ore in Finland.—Deposits of molybdenum ore occurring in the vicinity of the main line running from Joensun to Nurmes are now to be exploited. They were worked in 1910, but were subsequently abandoned as of little value. When, however, it became known that molybdenum deposits of smaller extent were being profitably worked in Norway, attention was once more directed to them. However, they were not regarded as payable by experts from the firms of Krupp and Creusot, who inspected them before the war; but conditions have materially altered since. Owing to the molybdenite being very sparsely distributed in the mother rock, the latter cannot be marketed; but it should be easily possible, after crushing and sorting, to market the concentrates, as is done in Norway.—(*Z. angew. Chem.*, *Oct.* 21, 1919.)

Principal Industries of Yugo-Slavia. — Speaking generally, the country has considerable stocks of raw materials, and conditions are favourable, but the industries are hampered by their dependence on foreign capital. In 1910 there were nine works manufacturing metals, chiefly iron; but none was of large size, nor was any equipped with the most modern plant. There are, however, rich iron deposits in Serbia, and a great development of mining is expected to take place there. Bosnia and Herzegovina produced some 2,800,000 tons of brown coal and 130,000 tons of first-quality coal, and there are many deposits as yet untouched. Manganese, antimony, pyrites, lead, and zinc mines exist, and in Idria (Slavonia) there are the famous quicksilver mines, which produce yearly 130,060 tons of ore, yielding 820 tons of mercury. Leather is manufactured in several factories, but the better qualities are imported; and there are six large and up-to-date sugar factories in the new provinces, which are capable of supplying the needs of the whole country. Sulphuric acid, Glauber salts, crystal and bicarbonate of soda are produced in Slavonia, and there is a powder factory at Kamnik, as well as some very important tannin factories at Zupanje and Mitrovich, in Croatia. Carbide works and petroleum refineries exist in Bosnia, and a considerable quantity of pure alcohol was formerly made in Batchka, Baranja, and Banat, but production has ceased for want of coal. In Serbia the chemical industry has only recently been introduced. There were a few acid works in Belgrade, as well as a soda works, two soap, one dye, and one match factory. Most of the factories and mines were destroyed during the invasion of the country by the enemy, but hope is entertained that the industries concerned will soon be revived. —(*U.S. Com. Rep.*, *Oct.* 1, 1919.)

New Coating for Safety-Match Boxes.—War shortage of antimony has led to the discovery of an excellent substitute for the preparation of the coating for safety-match boxes. The substitute, known as "brilliant friction," and manufactured by Sirkarna in Banska (Slovakia) is lighter, more effective, 50 per cent. cheaper, and effects a saving of red phosphorus and of chlorate of potash in the match heads. In a test over 500 matches were ignited on one box, and 100,000 boxes were coated with 1½ kilo. of amorphous phosphorus and 3 kilo. of "brilliant friction," which contains no pulverised glass or graphite. Large quantities have been exported to Sweden, Denmark, Holland, Austria, and Germany. —(*U.S. Com. Rep.*, *Sept.* 29, 1919.)

Chemical Industry in Sweden.—The preparation of essences has been started by the Roberts Co. in Oerebro. The Svenska Tändsticks Co. now owns the two factories at Trollhättan and Gullspäng, which make sufficient phosphorus, by the electrical smelting method, to satisfy the needs of the Swedish match industry. Potassium nitrate is made solely by the double decomposition method. The manufacture of common salt is being investigated by a Government Commission, and should the present high price be maintained the extraction of salt from the sea-water of the west coast may be undertaken. Uncertainty prevails as to the continuance by the Kväveindustri Co., of Gothenburg of the manufacture of products from atmospheric nitrogen and of that of sodium carbonate by the Leblanc method undertaken during the war. Of the many works started experimentally for the manufacture of chromium salts only one, the Sandsta Elektriska Smältverk will continue production now that importation has been resumed; an import tax on chromium salts is considered necessary to safeguard the future of this nascent industry. A factory is being built at Högonäs for preparing aluminium oxide from refractory loam by a process as yet unpublished for the manufacture of aluminium. The production of carbide and of calcium cyanamide as substitutes respectively for illuminating oil and Chile saltpetre has increased very greatly during the war, and the manufacture of ammonium sulphate from calcium cyanamide was also carried on, on a small scale, at the works at Ljunga. Owing to developments in the manufacture of caustic potash, caustic soda and bleaching powder, Sweden will probably be independent of foreign countries in the future for the supply of these commodities, but the production of sodium hypochlorite will be discontinued. A cyanide works to use 2000 kw. has been laid out at Trollhättan; a project for a factory

using 12,000 kw. to manufacture nitric acid electrically at the same place fell through, but the plans may be proceeded with at Porjus. The only factory placing atmospheric nitrate on the market is the Birkeland-Eyde at Ljunga, where there is also a small ammonia-oxidation plant. There is an extensive production of chlorate at Trollhättan, where some material other than platinum is used for electrodes; perchlorate is also made there.—(*Z. angew. Chem.*, *Sept.* 9 *and* 16, 1919.)

Position of the Dutch Chemical Industry.—The trade section of the Dutch Ministry of Agriculture, Industry and Commerce comments as follows upon the Dutch chemical industry during the first half of 1919:—Dutch chemical industry is in an unfavourable condition. In most branches production is much behind that of 1918. Some of the largest factories are either only operated in part, or are at a complete standstill. Fertiliser manufacturers have been adversely affected by the importation of large quantities of Chilean nitrate, the supplies on hand being more than sufficient to meet the country's demands. Financial difficulties are aggravated by a number of factors, including the delay occasioned by the necessity of securing export permits. Owing to fluctuations in price there is a disinclination to conclude contracts without a guarantee of immediate delivery. Trade generally is uncertain, and shows a downward tendency. Many dealers still possess large supplies, and are desirous of disposing of these abroad. The low exchange value of the mark exercises a considerable influence. Many firms experience difficulty in obtaining export permits, but there are no obstacles impeding importation of raw materials and partly manufactured goods from Central Europe; products of German origin are offered at prices considerably below the cost of the raw materials. In general the outlook for the chemical industry is not good. It is to be feared that the market will be flooded with cheap, foreign products. The export of surplus production is a matter of difficulty, and constitutes a very vital question for Dutch chemical industry.—(*Schweiz. Chem.-Zeit.*, *Sept.* 24, 1919.)

The Dutch paper industry did well during the war, but adverse conditions have ruled since the beginning of 1919. Japan and America have acquired many of the home and foreign markets previously supplied by the Netherlands. The industry is hampered by the high cost of coal and freightage, the necessary labour is lacking, and wages are high. The prospect before the export trade is not particularly bright at the moment, but it is anticipated that trade will gradually recover and a ready market be found in England. Raw materials for the artificial silk industry were more easily obtained during the first half of 1919, and the outlook is in general promising; the chief drawback to trade is the depreciated and fluctuating value of the mark and krone. There was a shortage of gas-making coals in the early part of 1919, and the low output of ammonia and ammoniacal liquor necessitated the importation of much Chile saltpetre. The prices of by-products, more particularly coke, tar and ammoniacal liquor, fell relatively more than that of coal.

The manufacture of foods and condiments, wines, etc., has revived with the increased importations of raw materials, and the outlook is bright. The output of sugar is below the normal on account of the diminished cultivation of the sugar beet, and costs have risen owing to the high prices of coal and limestone and high labour charges. The production of margarine has increased considerably owing to the importation of better raw materials; the future of this industry appears bright The brewing industry has still to contend with lack of raw materials. Ample supplies of raw materials are still at the disposal of the cocoa and chocolate industries; but the production cannot be exported, and it is feared that foreign markets will be captured by Switzerland and England. The output in the salt industry during the first half of 1919 did not exceed half the normal, and the position of the industry is still uncertain, largely on account of the impossibility of estimating the effect of salt production at Haaksbergen.—(*Z. angew. Chem.*, *Aug.* 15, 1919.)

Chemical Industry in Russia.—During the war Russia, like other countries, made considerable efforts to build up its own chemical industry, and many new chemical factories were erected; but, owing to the fear of future German competition, no foreign capital was attracted. Among the relatively larger new undertakings may be noted "The Russian Chemical Industry Co. (1914)" of Moscow, and the numerous factories of the former War Industries Committees, of which a toluene factory at Baku and a phosphorus works at Troitsk are still working. Although the many small chemical and pharmaceutical works established by the Russian Semstvos, and working simplified processes, are reported to be still active, there has been no progress in chemical industry since its socialisation by the Bolsheviks. Only three large chemical works, the soda factory of Ljubimoff, Solveigh and Co., the Lievenhof Glass Works and the Kusnezoff Factory at Lissitschansk are working in the Ukraine, and these are not fully employed. At the present time the stocks of pyrites and Chilo saltpetre in the Ukraine are respectively about 400,000 and 200,000 puds, and further imports to meet the needs of the sulphuric acid industry cannot be reckoned on. Materials of all kinds are lacking, including fuel, and whilst during the war the benzene works could, under favourable conditions, produce 80,000 puds of crude benzol, they could not now produce one-half this amount.—(*Z. angew. Chem.*, *Sept.* 9, 1919.)

Economic Resources of the Cartagena District, Colombia.—*Sugar.*—The Colombian Sugar Co., which owns plantations and a mill at Sincerin and is opening up new lands farther south, is the only large sugar plantation in the entire coast region using modern machinery. The average yield of cane is about 15 tons per acre, although a production of about 22 tons is often obtained. The price paid for the cane is about 10s. per ton delivered at the mill, and the percentage of extraction is over 9. The output averages 100,000 cwts. of refined sugar yearly.

Cotton.—American seed is largely used, but the native varieties are of long staple and high tensile strength, and are much less subject to damage by insects. The local demand exceeds the local supply.

Forest Products.—During 1918 Cartagena exported forest products gathered in the interior to the value of about £110,000, the chief items being ivory nuts, rubber (balata), and ipecacuanha. There is an unlimited supply of corozo (cohune) palms, which are spared for their seeds when pastures are cleared for cattle. The palm matures at the age of four or five years, and then yields two harvests yearly. The nuts, which are easily collected and of high food value, yield when dry about 25 per cent. of oil. Gum-yielding palms occur, but the collection of the gum in marketable quantities is not practised. The forests are rich in medicinal plants such as ipecacuanha, sarsaparilla, cinchona and cascara sagrada; these are exported to the United States to the value of about £10,000 yearly.

Petroleum.—The proved petroleum belt is believed to run from the north-east to the south-west, passing diagonally through Santander del

Norte near the boundary of Colombia and Venezuela (where the Carib Syndicate owns a concession of about 1,500,000 acres), and through Santander del Sur; but although well over £600,000 has already been spent in Colombia on oil exploration—which is much hindered by the broken country, poor climate, lack of transport, etc.—drilling operations so far have been unsuccessful.

Platinum and Gold.—The total yearly export of precious metals from Colombia is valued at about £1,200,000, and the country produces an average of 30,000 oz. (troy) yearly of platinum, practically all of which comes from the Quibdo district. During the war nearly all the Colombian output of platinum was taken by the United States (1916, 25,588 oz.; 1917, 21,278 oz.), and the fixing of the price at $105 per oz. by the U.S. Government during 1918 greatly stimulated the work, although, owing to the dry weather, which necessitated the laborious collection of water for washing, the production did not increase proportionately to the number of workers. The climate is unhealthy, and the quality of the labour unsatisfactory. Many rich samples of copper, lead, silver and palladium ores have been obtained in the Choco district by the native prospectors, but very little is known of the real extent or value of the deposits. There is a decided tendency in mining legislation towards the institution of Government control.—(*U.S. Com. Rep., Sept.* 22, 1919.)

The Spontaneous Ignition of Peat.—As a result of the investigation of many cases of spontaneous combustion in stored peat, Mr. A. Molin concludes that the cause of ignition may well be the same as that which effects the spontaneous ignition of hay, viz:, that *aspergilli* cause the initial rise of temperature to 60° C., and that other bacilli raise it further to 70° C., at which temperature inflammable gases arising from the decomposition of twigs and boughs would take fire. The author advises that peat which is to be stored over long period should contain a minimum quantity of smalls and dust, and that commercial analyses should state, in addition to ash and moisture contents, particulars as regards dust-content and strength of texture.—(*Tekn. Tidsk., Kemi a Bergvetenskap.*, 1, 1919.)

Wolfram in Siam.—In the fiscal year 1912–13 the production of wolframite in Siam was 309 tons; in the year ended March 31, 1917, 584 tons, and in the succeeding year about 800 tons, the monthly returns averaging from 70 to 80 tons. Deposits of tungsten ores, chiefly wolframite, diffused through Siamese Malaya and northern Siam, and especially the district Nakon Sritamarat, are said to be unlimited. High grade ores contain from 60 to 72 per cent. WO_3, but mixed ores containing nearly equal parts of tin and tungsten occur.

The war price reached 160 ticals (£12. 6s.) per picul (133⅓ lb.), the present price is about 40 ticals or less per picul. There is no use for tungsten in Siam, and the entire output during the first two years of the war went to the United Kingdom, France sharing to some extent in 1918.—(*U.S. Com. Rep., Sept.* 6, 1919.)

Natural Indigo in the Dutch Indies.—The Swiss Embassy at the Hague reports that considerable progress has been made of late by indigo growers in the Dutch Indies, where the area under cultivation in 1917 was about four times as great as in the preceding five years, but was still only about a half of what it was about twenty-five years ago.—(*Schweiz. Chem.-Zeit., Sept.* 10, 1919.)

Chinese Indigo Crop.—Owing to the very poor indigo crop in China in 1918 a larger acreage has been planted this year, and an increased production of indigo is expected. The crop is an average good one; in certain districts it suffered from excessive rainfall early in the season.—(*U.S. Com. Rep., Oct.* 18, 1919.)

GOVERNMENT ORDERS AND NOTICES.

PROHIBITED EXPORTS.

The Board of Trade (Licensing Section) has announced the removal from List "A" of Prohibited Exports of the following items: Scrap iron; steel scrap; nitrate bags (Nov. 27); and of bean flour; locust bean meal; margarine and oleo-margarine; lupin seed; jute, raw and carded; poppy and sunflower seeds; shea, illipe and babssu nuts (Dec. 5). The Board also intimates that the heading "Soya bean, cake and meal" should be interpreted as including soya bean cake, meal and flour.

NEW ORDERS.

The Order made by the Board of Trade on November 28 relating to the reduction of 10s. per ton in the price of coal supplied for domestic consumption and of coal used in producing gas and electricity for household purposes (this issue, p. 460 R), has been supplemented by instructions issued by the Controller of Coal Mines, under which all coal supplied by collieries for bunkering ships engaged in the home coasting trade is now charged at revised prices, which are the prices given in Schedule A, less 6s per ton.

Orders made by the Minister of Munitions. The Tungsten and Molybdenite (Suspension) Order, 1919, which suspends the operation of the Tungsten and Molybdenite Order, 1917.

The Flax (Irish Crop) Amendment No. 2 Order, 1919, which fixes the prices of six different grades of Irish flax.

PARLIAMENTARY NEWS.

HOUSE OF COMMONS.

Imports and Exports Regulation Bill.

This Bill, introduced in the House of Commons by Sir A. Geddes on November 19, has for its main objects: To constitute a Trade Regulation Committee; to regulate the importation of goods with a view to preventing dumping; to safeguard key industries and industries affected by the depreciation of a foreign currency; to assist the revival of hop-growing; to regulate temporarily the exportation of certain goods; and to authorise the granting of credits and undertaking of insurances for the purpose of re-establishing overseas trade.

The Trade Regulation Committee will consist of seven officials representing the Board of Trade, Treasury, and the Foreign Office, and ten Members of the House of Commons. Any Orders made by the Board of Trade will have to be approved by this Committee. Goods to which a prohibitive Order applies may be imported if the importer pays such sums to the Commissioners of Customs as are equal to the difference between the foreign value and the import price; and similarly such goods may be sold in the United Kingdom if the vendor pays the difference between the price charged and the foreign value, or satisfies the Board that the reduced price is due to depreciation or other cause. In the section dealing with the safeguarding of "key" industries, the Board is empowered to prohibit for three years the exportation of, *inter alia*, fuel, motor spirit, sugar, edible fats, opium and cocaine and their salts. The

list of scheduled articles, the importation of which may be prohibited, contains all synthetic dyes and drugs, chemical reagents, scientific glassware, etc., and is identical with that detailed in this Journal (1919, 314 R).

Sir H. Greenwood informed Mr. Clynes on December 4 that it has been decided to publish forthwith the Report of the Advisory Council to the Ministry of Reconstruction on Anti-Dumping Legislation. On the same date the Prime Minister announced that the Government did not intend to proceed with this Bill during the current session.

The Coal Industry.

In reply to Mr. Adamson, Sir A. Geddes announced that, as a direct aid to the cost of living, the Government had decided to lower the price of domestic and household coal by 10s. per ton; the reduction would also apply to bunker coal for coastal traffic. (See also previous page.) The average price of coal for inland purposes is below the cost of production, but the very high prices ruling for export coal allow of this concession being made.—(Nov. 24.)

Sir A. Geddes informed Sir Evan Jones that the profit for the quarter ended December 31, 1918, was about 3s. 1d. per ton of coal raised, after allowing for interest on loans and debenture capital and payment of royalties. The figure for the March quarter of this year is expected to be about 7½d. per ton.—(Nov. 26.)

Palm Kernels (Export Duties).

Replying to a question put by Lieut.-Commander Kenworthy, Mr. Dudley Ward stated that the French Government had imposed export duties on oleaginous produce shipped from French West African colonies to all destinations, including France. It was evident, therefore, that these duties had not been imposed as a retaliatory measure for the corresponding duty placed on palm kernels exported from British West African colonies to destinations other than the British Empire.—(Nov. 27).

H.M. Factory, Gretna.

Mr. Kellaway intimated to Mr. R. Young that no definite decision had been arrived at in regard to the future of this factory. Arrangements are being made for utilising such of the machinery and plant as is suitable for the repair of railway wagons.—(Nov. 27.)

Patents.

Mr. Doyle asked the President of the Board of Trade if he would consider the advisability of bringing in a Bill to improve and cheapen the facilities for persons of limited means to take out patents, and to prevent any patentee from selling more than 50 per cent. of his interest in his invention to his employer; and if he would further consider the advisability of appointing an Inventions Committee to consider and advise upon inventions of all persons of poor circumstances, and, if necessary, help them to protect their improvements.

Mr. Bridgeman, in reply, said that the Bill now before Parliament should, if passed, improve facilities for the grant of patents. It would not be practicable or advisable to appoint such a committee as that suggested. Under the present practice of the Patent Office, all possible help and assistance is given by the staff to every inventor in preparing the specifications and other documents necessary for obtaining patent rights.

Patent Office Library.

Sir M. Conway asked the President of the Board of Trade if the library may be kept open till 10 p.m. on two or three evenings a week, as the continued closing in the evening had caused great inconvenience to students.

Mr. Bridgeman replied that the desirability of reopening the library in the evening had not been lost sight of, but there had been difficulties in making the necessary arrangements owing to depletion of staff. Arrangements will be made at the earliest possible date to keep the library open every evening for several additional hours.—(Nov. 27) (cf. pp. 452 R, 453 R, of this issue.)

Petroleum Oil in Derbyshire.

Mr. Kellaway, answering Lieut.-Col. Clay, said that the Hardstoft well is the only one which has been completed to date, that it has given an average weekly production of 1,734 gallons, and that this yield should be largely increased when pumping machinery has been installed. No adequate estimate of the cost per gallon can be framed at the present time.—(Nov. 27.)

German Dyes.

Sir A. Geddes informed Major McKenzie Wood that approximately 200 tons out of a total of 600 tons so far requisitioned is now in transit. The Reparation Commission has not been formally established, and therefore no final decision has been taken as to the values to be credited to Germany. The prices to be charged to consumers will be announced shortly.—(Dec. 1.)

Price of Coal Gas.

Asked by Mr. Alfred Short if the reduction in the price of domestic coal would carry with it a reduction in the price of domestic gas, Sir A. Geddes replied that he hoped so, but there were other factors besides cost of coal determining the cost of gas. He could not hold out any hope of a general reduction in price before the next quarterly meter readings. Coal used for making gas and electricity is included in the coal to be affected by the 10s. reduction.—(Dec. 1.)

Employees in National Factories.

Mr. Hope, answering Mr. Gilbert, issued a statistical statement detailing the number of workers, male and female, engaged in each of the national factories on November 11, 1918, and at the present time. The total numbers are 305,888 and 33,654, respectively. The explosives factories now employ 3,375 workers, compared with 36,761 a year ago, and the anti-gas factories 216, as against 12,512.—(Dec. 1.)

Basic Slag.

Sir A. Boscawen, for the Board of Agriculture, and in reply to Mr. Forestier-Walker, said that it was quite possible to obtain basic slag with a total phosphate content of over 24 per cent. The deliveries of this grade during the five months ending October 31 last were 66,200 tons. Any shortage that may exist is due to excess of demand over supply, and the Board has no control over the production.—(Dec. 2.)

Linseed Cake.

The shortage of linseed cake, said Mr. Roberts in reply to Mr. Remer, is purely local, and is due to lack of adequate transport facilities. The recent export of 5,000 tons of American linseed cake to Holland was permitted as a special measure in order to relieve congestion at the ports. —(Dec. 2.)

Spelter.

In answer to Mr. Bird, Mr. Bridgeman stated that the agreement made in September, 1918, between the Ministry of Munitions and the British Zinc Smelters terminated on November 5 last, and under it the prices paid to the producers by the Government were considerably in excess of the prices realised on sale to consumers, but the actual loss cannot yet be given.—(Dec. 2.)

Superphosphates.

Sir A. Boscawen, in reply to Mr. Harry Hope, who asked that steps might be taken to facilitate the the importation of Algerian and Tunisian rock phosphate for use in superphosphate manufacture in place of the low-grade material now being obtained from America, said that arrangements have already been made in the direction indicated, and that the total deliveries from North Africa to the United Kingdom for the present year will amount to 277,000 tons. Next year much larger quantities should be available from this source.—(Dec. 3.)

Anglo-Persian Oil Co.

Answering Major Barnes, Mr. Chamberlain said that H. M. Government holds 2,000,000 £1 ordinary shares in this company out of a total of 3,000,000, and has agreed to subscribe for a further 3,000,000 shares, of which 2,000,000 will be shortly paid up in full and the call of 19s. on the remaining 1,000,000 will not be paid for some years.—(Dec. 3.)

LEGAL INTELLIGENCE.

WORKMEN'S COMPENSATION AND POISON GAS MANUFACTURE. *H. Dutton* v. *Sneyd Bycars Co., Ltd.*

In the Court of Appeal, on November 10, Lords Justices Warrington and Atkin and Mr. Justice Eve delivered judgment on an appeal from an award of the Judge of the Burslem County Court, sitting as arbitrator under the Workmen's Compensation Act.

Dutton became incapacitated by gas poisoning when engaged in the manufacture of poison gas in the defendants' factory. For a time he received full wages, but when he had partly recovered and was able to do light work for a colliery company these payments were reduced, and he claimed compensation under the Act. It was admitted that the disease contracted was not scheduled in the Act, but Dutton contended that the employers were estopped by their conduct from denying that the case came within the Act, and the County Court Judge upheld his view. Their Lordships, however, upset this decision, holding that the operation of the Act was confined to a certain class of cases, and the parties could not by any form of estoppel or by agreement extend the limited statutory jurisdiction.

ENGLISH PARTNERSHIP IN GERMAN PATENTS. *A. V. Derry* v. *C. R. Altenheim.*

In the Chancery Division, on November 17 and 18, before Mr. Justice Russell, Mr. A. V. Derry, a partner in the firm of W. Edward Kochs and Co., colliery machinery exporters, of Sheffield, sought a dissolution of partnership, dated April 17, 1902, between that firm and Heinrich Koppers, of Essen. The question at issue was whether the patents taken out by Koppers for coke ovens and by-products plant belonged to him or to the firm, and whether the Public Trustee, as custodian in whom the Board of Trade had vested the patents, held them absolutely or as trustee for the partnership (Koppers Coke Ovens and By-Products Co.). It was submitted by the partners that under the contract all English patents taken out by Koppers belonged to the partnership. The Public Trustee on the other hand contended that, but for the vesting Orders, the English patents would all be the property of Koppers, and were now vested in the Public Trustee absolutely.

His Lordship held that, although the patents were in Kopper's name, they had throughout belonged in equity to the partnership.

ALUMINIUM SULPHATE CONTRACT DISPUTE. *T. W. Watson and Co.* v. *Messrs. Mann and Cook.*

This case was argued in the King's Bench Divisional Court on November 20, before Mr. Justice Coleridge and Mr. Justice McCardie, the plaintiffs seeking to set aside an award made by two lay arbitrators in favour of defendants with regard to two contracts for the supply of sulphate of alumina. In February, 1918, Messrs. T. W. Watson and Co., of London, contracted to supply Messrs. Mann and Cook, also of London, with 50 tons and 40 tons of this material at £10 5s. per ton. The goods were not delivered, and defendants bought against plaintiffs at a much higher price, claiming the difference as damages. The arbitrators awarded defendants £517 10s. damages. The motion to set aside this award was based on the alleged erroneous conduct of the arbitrators.

It was eventually agreed between the parties that the matter should be referred to a legal arbitrator.

OFFICIAL TRADE INTELLIGENCE.

(*From the Board of Trade Journal for November 27 and December 4.*)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W. 1, from firms, agents or individuals who desire to represent U.K. manufactures or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the department mentioned and quoting the specific reference number.

Locality of firm or agent.	Materials.	Reference number.
Canada	Drug specialities	1092
,, ...	Glass, crockery	*
,, ...	Spices and vanilla beans	*
Ceylon	Oils, paints, perfumery, china, glass	1096
Egypt	Carbolic acid, nitric acid, candles, oils, paints, soap, leather, etc. (tender for)	†
New Zealand ..	Upright incandescent gas mantles	1094
Belgium	Aspirin, serums, pharmacentical products	1100
,, ...	Aniline and other wool dyes ..	1101
,, ...	Cement, plaster, refractories, pottery, etc.	1103
,, ...	Margarine, soap, cattle food ..	1106
,, ...	Special steel for tools, files, springs, etc.	1108
,, ...	Soap, perfumery	1159
Germany	Steel cylinders, spiegeleisen, steel alloys, high speed steel, engine oil, lubricating oil, tar oil ..	1113
Italy	Soap, perfumery	1115
,, ...	Electric high-tension porcelain insulators	1116
,, ...	Dyes, colours, paints, leather, paper, varnish, oils, roofing tiles	1163
,, ...	Paper, bricks, hides, leather ..	1164
Netherlands ..	Metals (copper, tin, zinc, aluminium, etc.), galvanised steel sheets	1165
Portugal	Drugs, hides, metals, cement ..	1119
Spain	Chinaware	1123
,, (Canary Isles)	Perfumery	1125
Palestine ..	Paint, varnish	1171
Morocco (French Zone)	Paints	1131
United States ..	Chemicals	1135
Argentina } Uruguay } ..	Iron, steel, black and galvanised sheets, metals	1173A
Brazil	Paint, glass, china, white metal sheets and wire, yellow metal, copper, zinc	1174
,, ...	Chemicals, drugs, tinplate ..	1175

* The Canadian Government Trade Commissioner, 73, Basinghall Street, E.C. 2.

† The Department of Overseas Trade, 73, Basinghall Street, E.C. 2.

Market Sought.—A firm in Portuguese East Africa able to export oil-seeds and copra desires to get into touch with importers in the U.K. [1132.]

TARIFF. CUSTOMS. EXCISE.

Argentina.—It is proposed to raise the import duty on whisky to 1 peso (gold) per litre or per bottle.

Australia.—Licences will be required for all goods on the prohibited list arriving in the Commonwealth after November 30.

Brazil.—Copies may be inspected at the Department of Overseas Trade, 73, Basinghall Street, E.C. 2, of the sections of the proposed new tariff relating to chemicals, drugs, dyes, perfumery and pharmaceutical specialities.

British Honduras.—An export duty at the rate of 2 dollars per 1000 has been levied on coconuts as from October 4.

British India.—The export of raw jute and of certain hides and skins is now generally permitted.

Denmark.—Export prohibitions have been removed from, *inter alia*, aluminium, antimony and its compounds, asbestos, bone oil, casein, cocoa, copper, copper ashes, copper alloys, cork, fatty acids, glue, glycerin, goat skins, gun metal, iron alloys, tinned and galvanised iron plates, kapok, lead, lead ashes, lubricants, nickel, resins, rubber, soap, tallow, tin, tin ashes, tin alloys, tungsten (raw), vanadium ore, vaseline, vegetable fibres, zinc, zinc ashes and zinc alloys.

Dominican Republic.—The new tariff comes into force on January 1, 1920, and is notable for the large number of articles placed on the free list. A copy of the complete tariff may be seen at the offices of the Department, 73, Basinghall Street, E.C. 2.

Esthonia.—The regulations respecting foreign trade are set out in full in the issue for December 4. Among the articles of "luxury" the import of which is prohibited are chocolate, wines, spirits, ornamental pottery, china and porcelain, certain kinds of glass and perfumery.

Falkland Islands.—Export duties of 1s. 6d. per barrel of 40 gallons have been levied on whale and seal oils, and of 1½d. per 100 lb. on guano of all kinds.

France (Algeria).—Copies of the Decree respecing the import, sale and storage of dynamite and other nitroglycerin explosives may be seen at the Department of Overseas Trade, 73, Basinghall Street, E.C. 2.

Germany.—The list of iron and steel manufactures exempt from export duty is given in the issue for November 27.

Jugo-Slavia.—Certificates of origin are required for all imported goods.

Madagascar.—The rates of duty leviable on imports covered by the "coefficients of increase" are the same, with few exceptions, as those leviable on similar goods imported into France under the Decree of July 8.

Paraguay.—The Tariff of Valuations has been revised and the official valuations of almost all imported goods have been greatly increased. Among the articles affected are drugs, medicines, glass, china, stoneware, leather, fine soap and perfumery, but edible oils, kerosene, salt, sugar, and soap are exempt from the increase. The Decree came into force on October 1.

Portugal.—The export surtaxes on cocoa and chocolate have been withdrawn.

Rumania.—Certain customs laws now in force have been extended so as to be applicable in Transylvania, the Bukovina, the Banat and other territories united to Rumania.

South Russia.—Licences will only be issued for the export of goods which have been covered by imports. The export of, *inter alia*, benzine, metals, ores, hides, salt, potash, soda, salomas (solidified sunflower seed oil), alcohol, and oil cake is reserved to the Government.

Spain.—The import of saccharin for use in the manufacture of cigarette papers is now permitted, and duty is leviable at the rate of 50 pesetas per kilogram.

It is proposed to revise the customs tariff and in the meantime to put into force a "transitory" tariff. The permanent tariff will probably be introduced in January, 1921.

Uruguay.—Among the articles the export of which is prohibited are dyes, imported medicines, iron, steel, copper, tin, lead, zinc, aluminium, antimony (and their alloys, including tinplate and galvanised iron), paints, varnishes, and imported pharmaceutical products.

TRADE NOTES.

BRITISH.

Trade of Hong Kong in 1918.—The world-wide shortage of mercantile shipping has had a marked effect upon the trade of the colony, which is almost entirely dependent upon ships for its prosperity. Decreases in the imports of oil (23,536 tons), coal (371,325 tons), and cotton yarn and cotton (23,556 tons) are put down to this cause. The imports showed an increase in the cases of liquid fuel (24,979 tons) and sugar (115,423 tons). Refined sugar was in great demand in China and the Persian Gulf, but here again business was restricted by the shortage of tonnage. The year was favourable for cement manufacturers, demand continuing to be good.

Trade has suffered by the political chaos existing in China. The statistical position of trade in most goods, however, is sound, and with settled conditions the prospects of business would be encouraging.—(*Col. Rep.—Ann.*, No. 1001, Oct., 1919.)

FOREIGN.

Dutch Imports of Chemical Products and Raw Materials.—According to "Maandstatistiek In- en Uitvoer" for 1917, 1918, and 1919 the imports of chemical products and raw materials into Holland for the first half of each respective year were as follows:—

Material.	1917.	1918.	1919.	Source.	Percentage. 1917.	1918.	1919.
	Tons.	Tons.	Tons.				
Soda ..	9,967	2,933	16,278	Germany	13·4	1·12	44·3
				England	05·4	94·9	54·4
Potash ..	4,037	340	710	Germany	100	59·5	94·4
Dyes ..	216	25	109	Germany	99·5	100	100
Organic dyestuffs	138	21	79	Germany	100	100	52
				England	—	—	45·5
Other chemical products	8,131	10,087	12,182	Germany	62·5	46·0	56·4
				England	13 0	4·3	15·4
				Norway	—	14·9	23·8
				Sweden	15·6	17·0	15·6
Turpentine	1,094	—	1,742	England	62·6	—	7·2
				U. States	31·3	—	79·7
Tar ..	201	—	2,259	Germany	1·5	—	31·5
				Belgium	—	—	26 1
				Denmark	—	—	11·6
Wax ..	—	1	251	England	—	100	83·2
Chile saltpetre	24,850	1,128	133,082	England	0·01	—	32·4
				U. States	40·3	—	7·2
				Chile	59·4	100	59·8
Sulphur .	48	—	316	England	—	—	82·3
				Italy	52·0	—	17·4
				Germany	45·4	—	—
Oleic and other fatty acids ..	63	981	4,289	England	100	99·9	83·0

—(*Z. angew. Chem., Oct.* 21, 1919.)

The Dutch Glass Industry.—A "community of interests" (I.G.) has been formed, embracing the firms "Manufacture Royale des Glaces de St. Gobain" in Paris and "De Schie" in Schiedam, which should result in a greatly increased output from the latter firm as soon as economic conditions permit. The former company has also established a "community of interests" with the "Eerste Hollandsche Vensterglasfabriek," in Maassluis. The "Eerste Hollandsche Vensterglasfabriek" contemplates supplementing its manufacture of window glass (Fourcoult process) by the production of other wares.—(*Z. angew. Chem., Oct.* 21, 1919.)

The Pharmaceutical and Chemical Industries of Spain.—In an article in *Le Industrie Italiane Illustrate* it is pointed out that for some time strenuous efforts have been made by the United States, France, and England to secure a hold upon the Spanish market before other countries are in a position to compete with them. Although the home production of a few specialities was increased during the war, it is insufficient to meet the demand, and, undoubtedly, the country offers a good market for pharmaceutical and chemical wares. The present position is, approximately, as follows: Resinous products are manufactured by the important Union Resinera Espanola, which has a capital of 20 million pesetas (peseta =9½d.), with many factories and branches. Important also are: La Pennaroa y La Sociedad Aninima Cros, La Sociedad Barcelonesa de Colas y Abonos, Industrial Quimica de Zaragoza, Etablissements Gallard, Union Espanole de Fabricas de Abonos, and others manufacturing mineral acids, superphosphate, glue, etc. Among companies of lesser importance mention should be made of the promising Solvay firm, which runs its own potash mines.

Three factories are being erected to produce nitrates by fixation of atmospheric nitrogen. One in Viana, has 8000 h.-p. available; another, at Lerida, uses over 25,000 h.-p., which could be increased to 75,000; and the third is in Corcubion. During the war other factories were started, but both their technical direction and their products are so poor that they are expected to close down when better supplies of nitrate become available from abroad. Imports for 1913 were as follows: Vegetable products, including coconut oil, palm oil and other vegetable oils, dye woods and barks, tanning materials, linseed and sesame, medicinal preparations, etc., 75,256 metric tons, of which linseed and sesame accounted for 70,848 tons. Imported dyes included mineral colours, dye extracts, prepared dyes, lakes, inks, tinctures, coal tar dyes, aniline oil, aniline hydrochloride, etc., and of the total 15,770 tons, Germany supplied 30%, France 27%, England 14%, and Italy 7·4%. Products such as acids (acetic, citric, tartaric, hydrochloric, sulphuric and carbolic), naphthalene, carbonates and borates, chlorates, chloroform, ether, phosphorus, lead oxides, etc., were imported to the extent of 23,052 tons, and were derived mainly from Germany, France, and England. Italy supplied chiefly citric and tartaric acids.

The writer of the article urges Italian chemical manufacturers to prepare for keen competition in regard to the supply of citric and tartaric acids not only in Spain, but also in America. Pharmaceutical products were imported from Italy to the extent of 546 tons. Italian manufacturers are advised to develop the production of medical supplies and perfumes, more especially as the raw materials therefor—sulphur, tartaric acid, mercury salts and quinine—are largely of Italian origin. Remarking on the strenuous attempts made by various countries to capture the Spanish market, the writer eulogises the efficiency of English propaganda in the Spanish chemical trade.—(*Z. angew. Chem., Oct.* 21, 1919.)

COMPANY NEWS.

ELECTRO-BLEACH AND BY-PRODUCTS, LTD.

An extraordinary general meeting was held in Manchester on November 14 to consider the directors' proposals to raise the nominal capital of the company from £180,000 to £480,000 by the creation of 200,000 7 per cent. participating preference shares of £1 each, and a like number of ordinary shares of 10s. each, and to issue 80,000 shares of each denomination.

Mr. H. J. Mackinder, chairman, in explaining the above proposals, referred to the profits made by the company for the years 1915—1918 (£31,492, £48,942, £48,068, and £60,751), to the dividends paid on the ordinary shares (7, 7, 10, and 12½ per cent.), and, in answer to the criticism that these were war profits and could therefore not be taken as a guide for the future, said that during these years many exceptional difficulties had been encountered and that their trading had been circumscribed by Government control. The money resulting from the proposed new issue would be devoted to repaying the Government (£45,890) for extensions and purchase of plant, to the redemption of the outstanding debentures (£50,500), and the balance to extensions and development. During the years 1914 to 1918 the sum of £220,793 was spent on buildings, plant, etc., in addition to the purchase price of £150,000, and these items had been written down in the company's books to £256,607. No value had been assigned to goodwill and patents. The profits for the current year were very satisfactory, and an interim dividend at the rate of 12½ per cent. per annum would now be paid in respect of the half-year ended June 30 last. The new shares would rank for dividend, *pari passu* with the old, immediately after the payment of this interim dividend.

Resolutions embodying the proposals were passed unanimously, and these were subsequently approved at separate meetings of the preference and ordinary shareholders.

ZAMBESIA MINING DEVELOPMENT, LTD.

On November 18, in London, Sir Alfred Sharpe, presiding at the sixth ordinary general meeting, stated that during the war the company had acquired the whole of the mineral rights over the extensive Zambesi coal area, in which exist not only coal, but gold, copper, iron, mica, and other minerals. The impending construction of the Beira-Zambesi railway should solve the problem of cheap transport, the existence of accessible coal in large quantities had been proved, and the quality of the coal was now being ascertained. In this connexion the services of Mr. E. H. Cunningham-Craig and of Mr. J. Arthur Greene, as technical adviser on minerals, had been secured. In a preliminary report the former states that the coal, as is common in South Africa, "is somewhat high in ash, but the percentages of volatile matter and fixed carbon are good." An analysis by the Director of Mines of the Companhia da Zambesia gave: Ash, 13·2%; coke, 75%; fixed carbon, 60%; calorific power, 12,400 B.Th.U.

New Capital Issue.—*Newcastle-upon-Tyne Electric Supply Co., Ltd.*, is issuing 1,500,000 7 per cent. cumulative preference shares of £1 each at par to finance extensions, etc. The company is the largest producer of electrical power in the United Kingdom, the total capacity of its plant being 370,000 h.-p. By means of new plant about to be installed it is hoped to effect a saving of over £100,000 per annum on coal consumption.

SANTA CATALINA NITRATE CO., LTD.

At the nineteenth annual general meeting, held in London on November 19, Mr. F. G. Lomax, chairman, said that the company had continued to manufacture nitrate at full rate until last January, and at half-rate from then to July, when the works were closed down. Hence the profit on only 135,000 quintals, viz., £18,986, had been taken in the accounts. A dividend of 20 per cent. for the year was recommended.

The Nitrate Association, which comprises all the producers except the German and two American-owned companies, which are debarred from joining by the Sherman Law, has made an auspicious start, having recently concluded sales aggregating some 25,000,000 quintals of nitrate for delivery during the coming season. (Quintal = 101·5 lb.)

BRITISH OIL AND CAKE MILLS, LTD.

In his address to the twenty-first ordinary general meeting, held in London, on November 19, Mr. J. W. Pearson said that it was proposed to increase the capital of the company from £2,000,000 to £10,000,000 by the creation of 8,000,000 new shares of £1 each, of which 1,250,000 would be issued at par forthwith. The funds to be provided by this issue are required as additional working capital to finance the steadily increasing business of the company, to facilitate the purchaso of raw materials at the high level of prices now ruling, and to add to the company's properties. An extensive soap works is being erected at Hull for the manufacture of toilet and household soaps; a margarine factory, refinery, compound lard factory and oil store are in course of erection at Gloucester; and a site on the James Watt dock at Greenock has just been acquired, upon which it is proposed to erect an oil mill designed, *inter alia*, to deal with palm kernels and copra, both of which materials are new to Scotland. It is, further, proposed to acquire a new site in London, where the company's trade has now outgrown its capacity. The directors look forward to a period of considerable expansion in the seed-crushing trade.

During the year covered by the accounts the entire business was under control of the Ministry of Food, but since the end of March last the trade has practically returned to its normal channels. The company's output is steadily growing, and at the present time is half as large again as that of last year, so that the directors have every confidence in the future. They believe that the speedy removal of every vestige of control by the Government in this and every other section of commerce is the true solution of the many problems that are still confronting British industry. The profit and loss account for 1918, after writing off £50,000 for depreciation and placing £49,441 to reserve, shows a credit balance of £217,567. Fifteen per cent. was paid on the ordinary shares for that year, and an interim dividend of 10 per cent. was distributed in September last on account of the current year.

The proposed increase of capital was sanctioned and confirmed at a subsequent extraordinary general meeting.

Capital Increases.—*Minerals Separation, Ltd.*—The share capital of this company has been increased to £500,000 by the creation of 450,000 new shares of £1 each.

British Cotton and Wool Dyers' Association, Ltd.—The nominal share capital is to be raised from £500,000 to £1,000,000 by creating 2,000,000 new ordinary shares of 5s. each. The object of the increase is to enable the company to make a partial return to shareholders of capital previously written off, by issuing one new share for every two shares now held by them.

ANGLO-PERSIAN OIL CO., LTD.

The report for the year ended March 31 last states that the net profit amounted to £2,010,805 which, together with £454,722 brought forward, makes £2,465,527, from which £1,200,000 is to be deducted in respect of all claims for excess profits duty up to that date. The preference shareholders receive 8 per cent. for the year, and the ordinary shareholders 10 per cent., free of tax. The carry forward is £275,528. The throughput of the refinery in Persia shows a substantial increase, and the high productivity of the oilfields is still maintained. Work on extensions has been delayed through difficulty in obtaining delivery of plant and machinery. It has been decided to increase the share capital of the company to £20,000,000 by the creation of 15,000,000 new shares of £1 each, whereof 3,000,000 will be £1 preference shares, 4,500,000 ordinary shares, and the balance of 7,500,000 will be issued as ordinary shares, subject to any direction of the company in general meeting to the contrary. There will also be issued £2,600,000 of 5 per cent. first debenture stock at £85 per cent. (£2,400,000 of this stock is already outstanding). H.M. Government, which in 1914 acquired a controlling interest in the company by the purchase of 2,000,000 ordinary shares, 1,000 preference shares, and £199,000 debenture stock, is subscribing for its proportion of the new ordinary shares. The new preference shares are to be issued at £1 3s. per share.

The above proposals were agreed to unanimously at a meeting of preference shareholders, and at an extraordinary meeting of shareholders on December 2. At the latter the chairman, Sir Charles Greenway, stated that the additional capital was required to extend pipe-lines, pumping stations and refineries in Persia; to complete the refinery in course of erection at Swansea; to establish new fuel oil bunkering installations at many British and foreign ports; to increase the distributing facilities of the British Petroleum Co.; to acquire additional tank steamers; to explore and test new territories; and to provide £1,000,000 towards the capital of Scottish Oils, Ltd. (this J., 1919, 277 R, 358 R).

COURTAULDS, LTD.

The directors have recommended that the capital be increased from £2,500,000 to £4,000,000 by the creation of 1,500,000 new ordinary shares of £1 each, ranking *pari passu* with the old; also that the sum of £1,999,993 be taken from the general reserve account and applied to the payment in full of ordinary shares to be distributed to existing shareholders on a share-for-share basis.

New Registrations. *British Cottonseed Products, Ltd.*, was registered on November 26 with a capital of £250,000 in £1 shares, to manufacture fibre, husks and other by-products from cottonseeds or decorticated cottonseeds, etc. The directors include Mr. J. W. Pearson and Mr. E. C. de Segundo.

Russo-Asiatic Consolidated, Ltd., has been formed with a capital of £12,000,000 in £1 shares, of which 8,456,972 shares will be issued in part exchange for the assets of the Irtysh, Kyshtim, Russo-Canadian and Tanalyk Corporations. £614,271 convertible 6 per cent. debenture stock will be issued in exchango for the outstanding debentures of the Irtysh and Tanalyk Corporations. The present programme for resumption of work at

the properties calls for production at the following rate:—Copper 10,000 tons, zinc 20,000 tons, lead 12,000 tons, gold 140,000 oz., and silver 1,700.000 oz. The profit on such output is estimated at £2,400,000 per annum.

REVIEWS.

Asphalts and Allied Substances. Their Occurrence, Modes of Production, Uses in the Arts and Methods of Testing. *By H. Abraham. Pp.* 606, *and* 208 *illustrations. (London Crosby, Lockwood and Sons.* 1919.) *Price 25s. net.*

This admirable monograph has been written from the points of view of the works chemist who tests and analyses the raw material, the refinery manager who blends the asphaltic and bituminous substances, the salesman who vends the finished products, and the engineer, architect and contractor who are the ultimate users.

A valuable historical review introduces the raw materials which were in vogue from about the year 3000 B.C. as cementing agents, as materials for sculpture and casts, for mummification and for building. The story is continued through the ages until modern times, when the use of asphalt for roadmaking forms its chief outlet. It is interesting to note that the first asphalt pavement in England was laid down in Threadneedle Street in 1869, the bituminous medium being Val de Travers asphalt. The nomenclature of the subject has been for a considerable period in a very fluid state; the author, at the outset, gives a convenient system, defining bitumen, pyrobitumen, petroleum, asphalt, asphaltite, tar and pitch, and including in his scheme mineral oil, asphalts, shales, mineral waxes, residual oils, grahamite, gilsonite, peat, lignite, cannel and bituminous coals.

The chemistry of bituminous substances is very briefly described, and it is assumed that the homologous series of paraffins, cyclo paraffins, "polycyclicmethylenes," "cycle olefines," and condensed aromatic systems occur in petroleum and allied substances, although very scanty experimental evidence is forthcoming. It is scarcely correct to say (p. 42) that "the composition of petroleum . . . . has been largely unravelled," although the lighter distillates are pretty well identified. So far as the reviewer knows, excepting the waxes, no definite and chemically characterised individual hydrocarbon has yet been isolated from the high boiling components of petroleum, and still less has any success attended the efforts to formulate the sulphur, oxygen and nitrogen containing constituents.

A convenient trilinear co-ordinate graph for carbon, hydrogen and oxygen in bituminous substances is described in this section, and examples of its application for classification are given. It is somewhat surprising that the author has not discussed the colloidal nature of the materials with which he deals. Attack from the purely chemical standpoint is particularly difficult, in view of the extreme complexity and the impossibility at present of effecting sharp separations between individual substances which are more or less decomposable. The colloidal condition, however, affords another avenue of approach and one of great promise. In the chapter devoted to the geological occurrences of bitumens, the author discusses briefly the origin of these substances, and concludes that they represent the more or less complete metamorphism of petroleum. The refining of asphalt by dehydration, sedimentation and extraction is shortly developed, and then follows a most comprehensive account of the sources, occurrences, properties and uses of the chief varieties of bitumen. This section is very fully illustrated by analyses.

A survey is made of the general methods for the production of tars and pitches, and the bituminous materials associated with the distillation of coal, wood, peat, lignite and shale are described, whilst the asphalts obtained from petroleum by topping, or air blowing, are discussed in detail and their blending described. The manufacture of paving materials, bituminised fabrics for roofing, flooring and insulation, adhesive compounds, waterproofing compounds, paints, cements, varnishes, enamels, and japans is handled very fully and comprehensively. The final chapters deal with the chemical and physical examination of the raw materials, intermediate substances and finished products, and form a most useful compendium from the point of view of the analyst. From the point of view of the get-up, printing, and illustrative matter, the book is exceedingly well produced, and this, in conjunction with the undoubted importance of the subject, makes it an invaluable addition to the petroleum technologist's library.

A. E. Dunstan.

The Nature of Enzyme Action. *By* W. M. Bayliss. *Monographs on Biochemistry, edited by* R. H. A. Plimmer *and* F. G. Hopkins. *Fourth edition. Pp. viii + 190. (London: Longmans, Green and Co.,* 1919.) *Price 7s. 6d. net.*

The appearance of a fourth edition of this work is a significant indication of its value and popularity as a general account of enzyme action. The principal change introduced in the new edition consists in the rewriting of the old chapter on "The nature of the combination between enzyme and substrate" under the new title, "The mode of action of enzymes." This chapter is of the highest interest to biochemists, inasmuch as it deals with the author's well-known "adsorption theory" of enzyme action, which has been consistently advocated throughout the various editions of this book. The author's view, as expressed in the general conclusions at the end of the book, is "that the 'compound' of enzyme and substrate, generally regarded as the preliminary to action, is of the nature of a colloidal adsorption compound so that the action of enzymes in general must be regarded as exerted by their surface. By surface condensation the reacting constituents are brought into intimate contact and reaction accelerated by mass action. Whether chemical combination between enzyme and substrate occurs in any stage of the process is not yet decided."

It is pointed out that the most serious objection to this view is afforded by the highly specific action with which enzymes are usually credited. To put a simple case. If the hydrolysis of cane-sugar is accelerated by invertase by means of a simple concentration of the sugar molecules and the hydrolytic agent (water or its ions) on the surface of the colloidal particles of the enzyme, why is this enzyme without action on other sugars such as maltose and lactose? And why are the enzymes maltase and lactase equally specific in their action?

The answer to such inquiries is that, in the first place, adsorption has in many cases been shown to be specific and to be conditioned by the chemical nature of the adsorbent and the adsorbed substance, and that, in the second place, it is probable that in many cases of enzyme action the specificity is not absolute but relative, one reaction proceeding very much more rapidly than the other. Both these contentions seem to require much further experimental

confirmation before they can be accepted as a sufficient explanation of the facts, and they obviously afford ample opportunities for research on this fundamental problem.

The frank and suggestive discussion of debatable points is one of the great charms of the present work, and the reader feels that not only is he being put into possession of well-established facts, but that the difficulties are faced and the too frequent gaps in our knowledge clearly indicated.

ARTHUR HARDEN.

STEREOCHEMISTRY. *By* A. W. STEWART. *Second edition. Text-books of Physical Chemistry edited by Sir W. Ramsay. Pp.* 277. (*London: Longmans, Green.* 1919.) *Price* 12*s.* 6*d. net.*

It is close upon half a century since Le Bel and van't Hoff, adopting a suggestion made independently by Wislicenus and Pasteur, developed the theory of stereochemistry, or the space arrangement of atoms in a molecule—a theory which immediately solved with striking simplicity many outstanding problems of isomerism among organic compounds.

The subject—partly from its novelty, and partly, no doubt, from the simple chemical and physical methods of investigation involved—attracted at once a number of workers. The amount of material which has since accumulated, and the various special treatises on the subject which have appeared, attest the interest which the theory has aroused.

The theory is based on the spatial distribution of the bonds or valency directions not only of carbon, but of any multivalent element, provided the bonds are capable of arrangement in three-dimensional space. Moreover, if the central multivalent atom is attached to radicals which differ from one another, an unsymmetrical figure may be produced, which, like a hand or foot, can exist in forms bearing the relation of object and mirror image which do not overlap, and which manifest themselves by rotary polarisation or optical activity of a right-handed and left-handed character.

In this way derivatives of carbon, silicon, sulphur, selenium, nitrogen, phosphorus, lead, and tin have been obtained in optically active forms. Although no very new developments have taken place in recent years, the subject is by no means exhausted, and there remain many unsolved problems which await solution.

The connexion between rotatory polarisation and asymmetry is still unexplained, and there is little apparent co-ordination between the quantitative value of the rotation produced by the combination of different radicals and their nature.

The meaning of the "Walden inversion," or change of sign of rotation by the replacement of one radical by another, as well as of geometrical inversion, or the conversion of one unsaturated compound into the isomeric form by different physical and chemical agencies, is still obscure.

Nor is the action of enzymes, or vital catalysts, in producing one or other of the active forms of carbon compounds the least complex nor the least fascinating of these problems.

Nevertheless, the principle of atomic space arrangement may be said to be firmly established, not only by its remarkable agreement with many authenticated facts, but by the direct experimental evidence of crystal structure so brilliantly demonstrated by the Braggs.

The new edition of Professor Stewart's book follows very much the former arrangement, and deals with every phase of this many-sided subject, which includes not only the stereochemistry of carbon compounds, but that of silicon, phosphorus, cobalt, chromium, and the platinum metals, as well as such subjects as "steric hindrance," in which space distribution of neighbouring radicals is supposed to be the underlying cause, the space formulæ of cyclic structures, including benzene, the arrangement of atoms in crystals, and the relation of stereochemistry to physiology. In the comparatively small compass of 260 pages it would scarcely be possible to enter into any great detail, but the ground is conscientiously surveyed, and the very complete list of references is not the least valuable part of the monograph.

We venture to draw the author's attention to the following errors and omissions which we have noticed in perusing a few of the chapters. The conversion of *l*-aspartic acid into *l*-chlorosuccinic acid by nitrosyl chloride (p. 63) was not the discovery of Walden, but of Tilden and Marshall, and the formula given to valine on the following page is that of aminobutyric acid. In the same chapter, on the Walden inversion, we can find no mention of the many important contributions to the subject by McKenzie and his co-workers, and the interesting case discovered by them of the difference in the effect produced by phosphorus pentachloride and thionyl chloride on the rotation of phenylchloracetic acid is also omitted. The author appears to follow Fischer in deriving *d*-gulose from *d*-glucose, whereas Rosanoff has clearly shown that *d*-gulose, *d*-xylose, and *d*-threose correspond in configuration to *l*-glucose, and that consequently *l*-tartaric acid corresponds to *d*- and not to *l*-threose (p. 57).

The chapter on steric hindrance, which occupied too large a share of the space in the previous edition, has been wisely curtailed and replaced by more valuable material. The book is too well known to need any recommendation from the reviewer, for it is unquestionably the most comprehensive treatise on the subject in the English language.

J. B. COHEN.

PUBLICATIONS RECEIVED.

BACTERIOLOGY AND MYCOLOGY OF FOODS. *By* F. W. *Farmer. Pp.* 592. (*London: Chapman and Hall, Ltd.,* 1919.) *Price* 28*s.*

IONS, ELECTRONS, AND IONISING RADIATIONS. *By James A. Crowther. Pp.* 276. (*London: Edward Arnold,* 1919.) *Price* 12*s.* 6*d.*

CHEMISTRY FROM THE INDUSTRIAL STANDPOINT. *By* P. C. L. THORNE. *Practical Text-Books of Commercial and Industrial Education. New Teaching Series. Pp.* 244. (*London: Hodder and Stoughton.* 1919.) *Price* 4*s.* 6*d.*

COMBINES AND TRADE ORGANISATIONS. *By John Hilton. Pp.* 138. (*London: Harrison and Sons.*) *Price* 1*s.*

A BIBLIOGRAPHY ON THE ROASTING, LEACHING, SMELTING AND ELECTROMETALLURGY OF ZINC. *Compiled by* H. L. WHEELER. *Bulletin No.* 3, *Vol. IV., of the School of Mines and Metallurgy, University of Missouri, revised to June,* 1919. *Pp.* 386. (*Rolla, Missouri,* 1918.)

PUBLICATIONS OF THE UNITED STATES GEOLOGICAL SURVEY. DEPARTMENT OF THE INTERIOR. (*Washington: Government Printing Office.* 1919.)

PHOSPHATE ROCK IN 1918. *By* R. S. STONE.

GRAPHITE IN 1918. *By* H. G. FERGUSON.

SODIUM AND SODIUM COMPOUNDS IN 1918. *By* R. C. WELLS.

ANTIMONY IN 1918. *By* H. G. FERGUSON.

SLATE IN 1918. *By* G. F. LOUGHLIN *and* A. T. COONS.

THE AMERICAN DYE INDUSTRY

The papers presented to the Dye Section of the American Chemical Society in September last, which appear in the November issue of *The Journal of Industrial and Engineering Chemistry*, throw interesting light on the problem of dye production as it presents itself to industrial chemists in the United States. It is now admitted on all sides that the national value of a flourishing dye industry is not by any means to be measured entirely on an economic basis, but is intimately involved in matters of such vital importance to national life as the maintenance of the educational and material standards necessary for defence against both military and commercial aggression. It is clearly realised that the growing American industry, with a present capital of over a hundred million dollars, must, like the British dye industry, be protected during its development against more experienced foreign competitors. This end is being secured by a procedure very similar to that adopted in this country. In the first place, a scheme was devised by which enemy-owned United States patents were compulsorily purchased and their use licensed under payment of royalties, thus rendering them available to manufacturers without risk of subsequent legislation; and, secondly, the Longworth bill, which is at present before Congress, proposes very material increase in the tariff rates on coal-tar products, and at the same time sets up a Licensing Board of consumers and producers to control the importation of such dyes as are not at present economically produced in the United States. The system is to continue for two years, at the end of which period it is thought that the industry will be firmly established.

The many problems arising in the actual synthesis of the colours are being vigorously attacked, and that considerable progress has already been made is borne out by the estimate that nearly twice as many different dyes are now made in the United States as were produced before the war. At the same time much still remains to be done, for less than a quarter of the different dyes imported before the war can as yet be manufactured by the home industry. This, however, includes many special dyes which were not used in large quantities. It will evidently be a very long time before the American dye industry approaches in efficiency the pre-war German standard, for an immense amount of research remains to be carried out even in the identification of the unknown dyes and intermediates, not to mention the working out of processes for their commercial production when identified. Thus, in dyes of the azo group alone nearly a hundred are at present unclassified.

The lack of knowledge of the constitution and method of manufacture of dyes is of course largely due to the complexity of the specifications of patents covering them. In the majority of cases it is extremely difficult to correlate a particular dye and the patent or patents covering its manufacture, for the patentee has naturally taken care to make the relation as obscure as possible, and has multiplied to the full the number of false trails upon which an investigator may be led away from the objective. Nevertheless, the patent literature is of very great value, particularly in indicating lines of research which are likely to give results of importance. The other obvious method for the solution of the problem of an unknown colouring matter, namely, the chemical analysis of the dye, followed by the working out of methods for its synthesis, is in most cases equally difficult. The chemical splitting of the molecule of an unknown dye may give rise to components which, besides being difficult to isolate, are themselves unknown or imperfectly described in the literature. In this connexion a proposal for the preparation of a complete catalogue of dyestuff intermediates is interesting. Such a catalogue, it is suggested, should include a brief description of each known intermediate and its relation to known dyes, and should be revised periodically as fresh information accumulates. A further suggestion is to the effect that the universities should co-operate with the industry both in the preparation of the catalogue and in research work on intermediates, particularly in the case of the amino-derivatives resulting, along with the common bases, from the disintegration of the azo dyes by reduction, these compounds being in many cases imperfectly known. The application of the principle of the direct co-operation of university laboratories in the solution of industrial problems, while no doubt valuable during times of special national stress, would appear to need very careful control if in the long run it is not to produce the very opposite of the effect intended. The university laboratories, which are the nurseries of chemical ideas, require direction from within upon idealistic lines, rather than from without upon utilitarian.

One of the chief difficulties facing the American dye industry is that of the economic production of certain of the more modern and valuable dyes, which, while their constitution and method of manufacture are more or less perfectly known, are so complex that their production on the commercial scale is at present impracticable. Numerous problems in the production of intermediates will have to be solved before such colours can reasonably be produced by American manufacturers. When it is reflected that nearly four hundred intermediates were utilised in Germany and Switzerland before the war for the production of dyestuffs, it will readily be realised that a considerable period must elapse before anything approaching the foreign range of colour products can be attained. The economic production of intermediates is, however, steadily progressing in the hands of American chemists, as may be illustrated by reference to the recent notable advance in the manufacture of phthalic anhydride by the atmospheric oxidation of naphthalene in the presence of a catalytic mixture of metallic oxides.

Besides the actual chemical processes involved in the manufacture of dyestuffs, attention has been given to the numerous problems arising in the mechanical handling of the various products, such as in the efficient drying, grinding and standardisation. These are in general physico-chemical rather than purely chemical questions, and physico-chemical methods have been applied for their solution. There is nothing particularly novel in the tests described for stability during such treatment, but the results are of great value as a guide in large-scale trials. Clearly, the accumulation of accurate information on such subjects as the explosibility and inflammability of materials to be handled in bulk is just as essential as the exact investigation of the chemical processes involved in their synthesis, and, although laboratory methods are not in general so reliable in the former case, they yet afford information which is at the same time serviceable and difficult to obtain in any other manner. A final paper deals with application of physico-chemical methods to the separation and purification of intermediate products and to the analysis of mixtures. Here again the methods described contain nothing new, although, as is pointed out, their present application in industrial chemistry could with advantage be very considerably extended. The physical chemist is capable of supplying invaluable data to the organic chemist

and to the chemical engineer for the solution of the problems of dye manufacture, though up to the present but little of his energy has been expended in this direction.

The dye industry in the United States would appear to have arrived at a stage corresponding very closely with that in our own country. Its development is being taken very seriously both by capitalists and by technologists, and it may be expected that within a very few years characteristic American enterprise and energy will have succeeded in making up much of the long lee-way which at present remains.

NOTES ON THE MANUFACTURE OF LETHAL GASES IN GERMANY. *

FRANCIS H. CARR.

The different stages of the process used in Germany to manufacture "mustard gas" (this J., 1919, 158 R) were curiously enough carried out in two widely-separated factories—the thio-diglycol being made in the Badische works, and the combination with hydrochloric acid being effected in the Bayer factory. At the former works the ethylene was made from ethyl alcohol vapour by passing over a catalyst of alumina contained in an annular tube of copper which was heated by a bath of molten potassium nitrate at 400° C. There were about 60 units, and some were always out of action. The catalyst remained active for about ten days only. The gas was passed through a scrubber to the reservoir, and from this through a meter, together with carbon dioxide delivered through another meter, into a horizontal cylinder which contained the charge of bleaching powder and water stirred by beaters. The hypochlorous acid, set free gradually by the carbon dioxide, entered into violent reaction, which was moderated by external cooling, the liquid being circulated through a coil traversed by cold brine, the temperature being thus kept down to about +5° C. After three or four hours the mixture was pumped through filter presses which retained the calcium carbonate, and the liquor sent to the rectifying still, where it was concentrated to 20 per cent. chlorhydrin. In peace time this was used in the manufacture of indigo, and the greatly increased production is now again available for this purpose. The chlorhydrin is then converted into thiodiglycol in a caustic soda plant near by and concentrated in a Kestner evaporator. After separation of the sodium chloride the thiodiglycol is run into tank wagons to be conveyed to the Bayer works. Here the hydrochloric acid gas is passed through glass tubes into it in a reaction vessel fitted with a good stirrer. The simple, but effective, accessories of this, such as the gravity floats to show the amount of liquid, small sample tubes for testing to find the end of the reaction, etc., were designed by the chemist in charge. Glass hoods connected with exhaust ducts were fitted both above and below the reaction vessels, which were about 7 feet in diameter and 6 feet deep. The operation was thus made so safe that it was claimed that only one casualty, not fatal, was experienced in the history of the process. The contents of the vessel were then sucked into another for washing, and again into another for removal of low boiling impurities by vacuum distillation. The purified product was then diluted with carbon tetrachloride and sent to the shell-filling sheds. The criticism has been made that the method used in Germany was complex compared with that which was worked out and used in this country. The operations, however, proved quite easy to a nation possessing such efficient plant and such a high organisation and co-operation between the chemist and engineer. Probably no great need was realised for a more direct process. The impression gained throughout the visit was that any chemical synthesis was regarded as quite easy; adequate pains and due precautions being taken as a matter of course, the result was sure.

The manufacture of arsenic compounds used in gas warfare was carried out in Germany on the dye plants (in the "azo-house") by a simple method. Diazobenzene chloride was coupled with sodium arsenite in the presence of a little copper, and the phenylarsenic acid formed was reduced by sulphur dioxide to phenylarsenious acid. This was sent to another works to be coupled again with diazobenzene chloride, and the resulting diphenylarsenic compound reduced to the diphenylarsenious compound as before. The product was sent to yet another works to be converted into the chloride by the action of hydrochloric acid. The yields were variable, but averaged 60 to 70 per cent. of the theoretical. The cyanide is easily prepared from the chloride by treatment with potassium cyanide. Ethyl dichloroarsine was prepared by combining arsenious oxide with ethyl chloride at 100° C. with vigorous stirring to form ethyl arsenious oxide. The oil was then chlorinated at a pressure of 12 atmospheres, the reaction taking 12 to 16 hours; and finally treated with sulphuric acid and sulphite.

The preparation of dichloromethyl ether was carried out by the dye factories apparently without sufficient physiological investigation, for it had little effect in the field. It was made by adding chlorsulphonic acid to paraformaldehyde dissolved in sulphuric acid and blowing air through the mixture to get rid of the excess of hydrochloric acid.

The preparation of di-phosgene proved very troublesome. Methyl formate was chlorinated in vessels furnished with chlorine pipes and carefully lined first with lead and then with two layers of tiles. (The cement was said to consist of powdered fire-clay, asbestos and sodium silicate.) These precautions are necessary, because any metal introduced into the mixture from the reaction vessel acts as an anti-catalyst. Tho temperature has to be varied during the reaction to obtain the best results, and further, the action of light is necessary. This was supplied by Osram lamps of 4000 candle power. The reaction takes from 6 to 8 days for completion, and the escaping gases caused many casualties. After all, the di-phosgene proved no more effective than phosgene, the preparation of which is relatively easy. The carbon monoxide used was made from air, not oxygen. The acting gases were passed through meters and the product condensed by freezing.

Other compounds made for this purpose were brominated acetone (lachrymatory), also methyl sulphate and phenylcarbylamine chloride.

On account of his connexion with the British manufacture of box respirators, the lecturer was specially commissioned to inquire into the German activated charcoal, which had proved so efficient. Analysis of some specimens had shown the presence of zinc in traces. This clue was of assistance, and led to the investigation of a plant used for making the charcoal. Ordinary wood was splintered and treated with hydrochloric acid and a little zinc chloride. It was then gently charred in retorts lined with tiles in order that they might resist the action of the vapours evolved. The finished product was thoroughly washed, and should have been free from zinc. The original presence of the zinc compound in the charred wood produces a highly absorptive charcoal.

* From the Chairman's Address to the Nottingham Section, October 22, 1919.

HISTORY OF MUSTARD GAS.

ARTHUR G. GREEN.

In a further article on "mustard gas" (this Journal, 1919, 432 R) Sir William Pope seeks to correct some "chemical fallacies" into which he believes that I have fallen.

He argues that Guthrie (J. Chem. Soc., 1861, **13**, 134) could not possibly have produced mustard gas by the interaction of ethylene and sulphur monochloride, for the following reasons:—

(1) That mustard gas is not produced by this reaction at temperatures much above 60°.

(2) That mustard gas is at once destroyed (chlorinated) upon heating with sulphur monochloride at temperatures higher than 60° or 70° C.

(3) That had Guthrie placed a drop of actual mustard gas under his tongue death would certainly have resulted.

Sir William Pope also asserts that if the Levinstein mustard gas is diluted with an organic solvent such as alcohol or ether the sulphur separates, leaving a solution of the monosulphide. My suggestion that this product is probably a disulphide is therefore, in his opinion, "conclusively refuted."

Whilst I am loth to join issue again with Sir William Pope on these matters, I am compelled to submit that on all these points he is entirely in error.

To exclude all possible doubt, I have recently carried out some further experiments with the kind assistance of Mr. H. F. Oxley. Though the details of these experiments would be out of place here, I am prepared to demonstrate to Sir William Pope, at his convenience, the truth of the following facts:—

(*a*) Mustard gas can be produced of satisfactory purity and in good yield by reacting ethylene with sulphur monochloride at a temperature which is never below 100° C. throughout the whole operation.

(*b*) Mustard gas, whether the monosulphide or the disulphide, is not materially attacked by sulphur monochloride even when heated with it to 100° C. for some hours. The only essential condition for the success of this and the preceding experiment is the employment of pure materials and the entire absence of iron. The latter condition, though present in Guthrie's experiment, is, of course, not fulfilled in the large-scale manufacture, and hence the necessity in this case of working at a low temperature, upon which point we were the first to insist.

(*c*) The Levinstein mustard gas, when prepared under correct conditions, does not deposit sulphur upon dilution with alcohol or ether. The contrary assertion by Sir William Pope is probably based upon an early observation made in our laboratory which was subsequently found to be erroneous. The small quantity of sulphur deposited by some samples is doubtless due to a little free sulphur arising from by-reactions.

My suggestion that the Levinstein product is a disulphide, possibly having the structure

$$\begin{matrix} C_2H_4Cl \\ C_2H_4Cl \end{matrix} > S = S,$$

is also supported by a molecular weight determination made by Prof. C. S. Gibson. This gave the number 187 (theoretical for the monosulphide 159, for the disulphide 191). It is, however, quite immaterial to my argument whether the Levinstein product is a disulphide or a "pseudo" solution of sulphur in the monosulphide, as in either event it is not identical with Sir William Pope's preparation.

In reference to the latter's third argument against anticipation by Guthrie, I maintain, though I have not tried the experiment, that his belief in a fatal termination is erroneous. There is, in fact, every reason for thinking that a drop of mustard gas would be less injurious when placed upon the tongue than when applied to the external skin, firstly, owing to the repellant effect of the moist surface to the oily insoluble liquid, and, secondly, because of the known power of rapid renewal possessed by the mucous membrane. I am supported by expert medical opinion in the view that an ulcer so produced would heal within two weeks.

To sum up the matter, which I now propose to leave to the judgment of the chemical public, the claim advanced on behalf of Guthrie as the discoverer of the disulphide mustard gas rests on the following evidence:—

(1) The analysis of the product which corresponds to the formula $C_4H_8Cl_2S_2$.

(2) The approximately correct specific gravity.

(3) The physiological action.

(4) Our repetition and confirmation of Guthrie's observations.

Though in the light of the above facts Sir William Pope cannot maintain his claim to have originated this reaction, or to have ever produced the disulphide product prior to our investigations, to him and to his collaborator must certainly be conceded the credit of having been the first to obtain the pure dichlorethylmonosulphide by employing sulphur monochloride; thus lending a great stimulus to the work of others in the field, and contributing to the final successful solution of the problem.

THE IMPERIAL MINERAL RESOURCES BUREAU.

S. J. TRUSCOTT.

As the late war developed into one between materials as well as between men, the absence of effective co-ordination between the various Government Departments concerned with minerals and metals became painfully evident, arousing many almost to fury. To better purpose, the four senior organisations representing the mineral and metal industries, namely, the Iron and Steel Institute, the Institute of Metals, the Institution of Mining Engineers, and the Institution of Mining and Metallurgy, urged upon the Government, through the Department of Scientific and Industrial Research, the formation of a Department of Minerals and Metals, to include the Geological Survey and to be in close touch with similar departments under the Dominion Governments. Other organisations —notably the Imperial Institute—were active in the same direction. As a result, the matter was brought up before the Imperial War Conference in 1917, by whom it was referred to a specially appointed committee for report. This committee recommended the setting up of an Imperial Mineral Resources Bureau, whose duties would be:—

(*a*) To collect, co-ordinate, and disseminate information as to resources, production, treatment, consumption, and requirements of every mineral and metal of economic value.

(*b*) To ascertain the scope of the existing agencies with a view ultimately to avoid any unnecessary overlapping.

(*c*) To devise means whereby the existing agencies can, if necessary, be assisted and improved in the accomplishments of their respective tasks.

(*d*) To supplement those agencies, if necessary, in order to obtain any information not now collected, which may now be required for the purpose of the Bureau.

(*e*) To advise on the development of the mineral resources of the Empire or of any particular parts thereof in order that such resources may be made available for the purposes of Imperial defence or industry.

The above recommendation was endorsed by the Conference, and the Ministry of Reconstruction was instructed to take measures to put it into effect. Accordingly a governing body was constituted by the appointment of one governor by the Home Government to be the chairman, one governor by each of the self-governing Dominions, one each by the Government of India and the Secretary for the Colonies, while six representatives of the mineral and metal industries were appointed by the Ministry of Reconstruction after consultation with the principal organisations representing those industries.

The Bureau so constituted was set up in July, 1918, and received its Charter in June, 1919.

The appointed governors are largely technical men, a minority being administrators, the chairman being Sir Richard Redmayne, lately Chief Inspector of Mines under the Home Office. Among themselves, these governors have divided the work under the following committees:—(1) Intelligence and Publications; (2) Research and Development; (3) Legal Matters; (4) General Purposes and Finance. In addition, they have formed outside consultative sub-committees, some of the members of which have been nominated by the industries concerned. There are, for instance, sub-committees for iron, steel, and metals used in steel-making; lead and zinc; copper; tin, gold, silver, platinum, etc.; chemical industries; refractories; coal and solid fuel; petroleum, etc.

The department of Intelligence and Publications has naturally got to work first, Mr. T. Crook, lately Mineral Assistant on the staff of the Imperial Institute, having been appointed director, and Mr. A. Jones, librarian. It is this department which, using the terms of the original reference, will concern itself with the collection, co-ordination and dissemination of information as to the resources, production, treatment, consumption, and requirements of every mineral and metal of economic importance. For the present, its activities will be largely restricted to the collection and publication of statistics. The figures of production of foreign and colonial mines, formerly issued by the Home Office as Part IV. of its Annual Mineral Report, will in future be issued by the Bureau.

The Department of Research and Development has not yet been completely organised. It was, however, in connexion with this department that an examination was made early this year into the general conditions of the Cornish tin-mining industry.

The Legal Department has set to work with professional assistance to assemble and compare the various mining laws of the world, with the intention of issuing a synopsis, in due course.

In encompassing all it has in view the Bureau will seek to avail itself to the fullest possible extent of all existing organisations, such as the Imperial Institute, the Imperial Colonial Institute, and the industrial organisations already mentioned. The work of these it will co-ordinate, extend, and, where advisable, assist.

The value of prompt and reliable statistics hardly needs to be argued. They enable the trend of output and consumption to be forecasted. They disclose the nature of a decline in output from any particular field, showing whether that decline be due to exhaustion or to catastrophal factors unconnected with the deposit, internal revolution for instance. They make clear the recurring discovery of metalliferous fields. They provide bases for the long-period computation of metal prices, metal production, costs, and mine life. In normal times they allow an intelligent anticipation of scarcity and high price, or abundance and relatively low price.

With regard to textual publications, descriptions of occurrence, together with statements of the use and value of minerals and products, are most valuable, as also are suggestions for the industrial application of new products, and inquiries for products to meet the wants of new industries. Periodical reviews of each industry in turn are invaluable.

In respect to research and development much the same can be said. In case of national necessity—and *faute de mieux*—the Bureau could advise Government to take over and exploit any particular deposit. Ordinarily its assistance would be in the nature of examination and advice, though in special cases it could make recommendations for financial assistance. In the matter of prospecting for new fields, one of the greatest necessities of the day, the Bureau will probably find its chance of being of greatest service to the Empire.

The value of the Bureau in respect to legal matters lies at the moment particularly in the fact that mining laws have to be propounded for the several new countries which have come under British sway. For mining rights in these the Bureau is already receiving inquiries and requests for concessions, and it seems likely that it will issue licences for mineral rights, in the Crown Colonies, at least, just as the Colonial Office now does, and probably in place of that Office.

Co-ordinating these several departments is the Secretary of the Bureau, Major L. M. Henderson Scott, A.R.S.M., with a growing staff.

This Bureau, being an Imperial Bureau, is supported financially by all the Governments separately represented upon it, and its interests, accordingly, are imperial. At present, for instance, it is no more concerned with the development of the mineral resources of Great Britain than it is with those of Canada. Each Government concerns itself with its own resources quite apart from the Imperial Mineral Resources Bureau. Thus, about the middle of this year, a Mineral Resources Development Committee was appointed under the Board of Trade to take evidence as to the needs of the industries of Great Britain. This committee is for non-ferrous metals, and it includes men who are particularly well acquainted with several such metals. It constitutes a step beyond the late Mineral Resources Development Department of the Ministry of Munitions, its principal duty being to appraise the conditions and wants of the non-ferrous industry in Great Britain, with a view to the national development of that industry. If a case is made out then a Ministry of Mines would result, wherein would be assembled all the various mining and associated departments, the Inspection Department from the Home Office, and perhaps the Geological Survey. The chances are that a Mines Department will be set up in the Board of Trade.

Manufacture of Alcohol from Ethylene.—In a paper read before the Cleveland Institution of Engineers, Middlesbrough, Mr. E. Bury, of the Skinningrove Iron and Steel Works, states that a large-scale process has been worked out for producing ethyl alcohol from ethylene, recovered from coke-oven gas, and sulphuric acid. The yield is 1.6 galls. of alcohol per ton of coal carbonised, and the optimum temperature of absorbing the ethylene is 60°—80° C.

THE SALTERS' INSTITUTE OF INDUSTRIAL CHEMISTRY.

At Salters' Hall, E.C., on December 11, the Salters' Company celebrated the foundation of its Institute of Industrial Chemistry by giving a dinner to which a number of leading chemists was invited. The Master, Mr. W. M. B. Bird, presided, and the guests included Sir William Pope, Sir J. J. Dobbie, Sir Herbert Jackson, Mr. John Gray, Mr. R. A. Perry, Mr. W. J. U. Woolcock, and other representatives of the profession of chemistry. Lord Moulton was unavoidably detained in the House of Lords.

In proposing the toast of the Institute, the Master said that the Company had come to realise that it has more important functions to perform than those of miscellaneous charity and conviviality, and that it must either go forwards or backwards. In truth, the Company in moving forwards is also retracing steps which it took some centuries back when it was identified with chemical industry through its members being recruited from the ranks of those who dealt in "flax, hemp, logwood, cochineal, potashes, and almost every chemical preparation," including beer. As a subsequent speaker remarked, the new policy has for its keynote education, and the Company is to be heartily congratulated on its initiation. One of its aspects, in particular, appeals to commonsense, viz., the devotion of funds to the training of scientific chemists rather than to the erection or elaboration of material structures. Thus there neither is, nor can be, a "housing problem" for the Salters' Institute. At the moment twelve students are in receipt of bursaries, of the value of £250 each, to enable them to continue their post-graduate studies in existing institutions, and thirty-four students of the artisan class are receiving pecuniary assistance to help them to meet their expenses at evening schools and colleges. A point which appeals more especially to those with educational experience is that the beneficiaries are chosen, not on the basis of the results of a rigid set examination, but by a Director who is in every way qualified to assess their qualifications and to guide them in their subsequent studies. In this arrangement the Company has not only shown faith in an autocracy of merit, but also true educational insight.

Dr. M. O. Forster who, as Director, responded to the toast of the Institute, referred to the good work which had been done by many of the Guilds—the Goldsmiths', Clothworkers', Leathersellers', Skinners'—acting jointly as the City and Guilds of London, in promoting scientific and technical education; during the past forty years over a million sterling had been expended in this connexion, and to this sum the Salters' Company, which is not a rich one, has alone contributed between £40,000 and £50,000. The results of this expenditure had been magnificent.

The toast of "Science and Industry" was given by the Upper Warden, Mr. H. L. Cancellor, and responded to by Sir William Pope, and Mr. R. Grosvenor Perry. The latter singled out two points for especial consideration—the freedom from labour troubles in the chemical industry during the past 100 years, which he thought might be ascribed to the comparative wealth of educated men in the industry, and the baneful influence of State control in normal times. The remarks of these and subsequent speakers bore testimony to the unanimous opinion that, in attacking the problem of efficiency in chemistry from the educational standpoint, the Salters' Company had made a most auspicious start, and one well worthy of emulation by sister Companies and kindred organisations.

SOCIETY OF CHEMICAL INDUSTRY

CROSS AND BEVAN ESSAY PRIZE AND LATHAM RESEARCH FELLOWSHIP.

The Council has pleasure in announcing that through the generosity of Messrs. Cross and Bevan, and of Sir T. P. Latham, Bart., of Weybridge, a prize is again offered for an essay on the Interconnexion of Economic Botany and Chemical Industry; also a fellowship endowment. The amount of the first prize will be £30, and it will be in the discretion of the Council to increase this amount in the event of the adjudicators reporting that one essay is of distinguished merit, or, on the other hand, to award a second and possibly a third prize.

A Research Fellowship with the sum of £300, the gift of Sir T. P. Latham, Bart., will be awarded to a successful essayist, subject to the following conditions:—The £300 will be paid either in two or in three annual instalments (at the discretion of the Council) to such one of the competing essayists as may be judged to be of conspicuous ability, as a grant towards his expenses, on the condition that he apply himself during two or three years respectively to research of approved character on a subject cognate with that discussed in his essay.

The immediate object of the donors is to promote the study of Economic Botany, with special reference to its bearing on Chemical Industry, giving the widest possible interpretation of the relationship. They desire, under the auspices of the Society, to assist in forming public opinion in this direction, and to discover and assist the career of a student of promise who may wish to devote himself to work in such a field.

For the guidance of prospective competitors, the following suggestions are made as to various aspects of the subject which may be dealt with, but essayists are not debarred from dealing with it on other lines which they themselves may select:—

1. Investigations by which definite chemical processes occurring in the plant or cell have been established and elucidated in connexion with the production of industrially useful substances. Suggestions or forecast of extension of this line of research.

2. The question of appreciation of values of primary products, *i.e.*, by way of:—(a) Quantitative production or yield; (b) Qualities on which industrial applications depend.

3. In typical cases to show why a plant or crop occupies its present economic position. The prospects of substitution (a) by allied species; (b) by chemical manufacturing processes, *i.e.*, in the case of "molecular" end-products.

Essayists should give as complete as possible a historical account of the work that has been done, with references, and also a bibliography. They are encouraged to give the result of any original work which they have done, and to indicate future lines upon which they consider that research may profitably be conducted in connexion with the subject of which their essay treats.

The Essay Prize will be open to all members of the Society who are British-born subjects, and there is no age limit. The Research Fellowship will be restricted to competitors who shall not have attained the age of 27 years at the time of sending in the essay.

Essays must be received at the offices of the Society not later than December 3, 1920; but in the case of competitors resident in the Colonies or elsewhere abroad, essays will be received up to the end of February, 1921, provided such competitors intimate to the Secretary of the Society, not later than September 30, 1920, their intention to send in competing essays.

The award shall be made as soon as all the essays have been received, but neither the prize nor the fellowship will be awarded unless the essayist, or essayists, shall be deemed to have real merit. The Latham Research Fellow will be required to submit a report at the close of each year to satisfy the Council that he has made, and is likely to make, proper use of the grant.

J. P. Longstaff (*Secretary*).

NEWS FROM THE SECTIONS.

MANCHESTER.

Mr. John Allan presided at the third meeting of this Section, held on December 5, when 127 members were present.

Dr. E. Ardern read a paper on "The Activated Sludge Process of Sewage Purification," embodying a continuation of his earlier work on this subject. A detailed account was given of the working of a large scale continuous-flow unit for the treatment of Manchester sewage (Withington Works) by the Activated Sludge Process. The plant was installed in December, 1917, and was designed to treat 250,000 galls. of sewage per day, with an average aeration period of four hours. No difficulty has been experienced in effecting uniform distribution of the air employed, the consumption of which varies from 0·8 to 1·5 cu. ft. per gallon of sewage treated. The recovered sludge amounts to 0.6 ton (dry matter) per million galls. of sewage, and it contains 6·5 per cent. of available nitrogen. A description was also given of a larger plant erected at the Davyhulme (Manchester) Outfall Works, and of other plants installed in different parts of the country.

The second paper was by Messrs. F. S. Sinnatt and Burrows Moore on "A Method for Determining the Relative Temperatures of Spontaneous Ignition of Coals." The method consists in dropping a small quantity of coal into a crucible maintained at varying but definite temperatures and observing (1) the time at which the coal begins to glow, (2) the time at which spontaneous ignition or explosion occurs, and (3) the time of cessation of glow. Results for a number of coals show that (1) is comparatively regular, and it is suggested that the time-temperature curve obtained should be used for characterising coals. Two examples were given of the curves obtained from coals which are known to produce gob fires, and these curves differ materially from those obtained with ordinary bituminous coals. Preliminary experiments show that the fineness of the coal has a great influence upon the temperature at which glowing occurs, and with mixtures of fine and coarse coal this temperature tends to approach that of the finest material. Other experiments indicated the effect of pre-heating the coal upon the temperature at which glowing occurs. The research appears to be of importance from the point of view of the storage of coal, and, when further work has been done, it may be of value in the study of gob fires.

During the evening a demonstration was given of a "Super-microscope" by Messrs. F. Davidson, of London. This combination of microscope and telescope enables direct microscopic observations to be made on objects which could not be examined upon the stage of a microscope.

NOTTINGHAM.

At the meeting held on December 9 the chairman, Mr. F. H. Carr, announced a forthcoming paper by Dr. E. B. Maxted on the "Fixation of Atmospheric Nitrogen."

Mr. S. Coffey then read the results of a research on "The Effect of Heating Linseed Oil Under Pressure and its Bearing on 'Litho' Oils." Previous investigators had heated the oil in open tubes and had noted certain changes in the physical and chemical constants. The author's experiments were made with sealed tubes, and the changes observed were plotted in the form of curves, which show an increase in the density, viscosity, and free acid values, constancy of the saponification value, and a decrease in the iodine absorption and in the amount of bromine addition product insoluble in ether. A marked discontinuity was apparent in the density, viscosity, and free acid curves after about 21 hours heating at 250° C. After about seven hours a portion of the oil became insoluble in acetone. Theoretical explanations of these effects were put forward.

As regards the production of "litho" oils or varnishes, it appears that there will be a marked difference in the composition of "thin" and "strong" varnishes, the latter consisting mainly of the product insoluble in acetone, while the former will contain less of this product. The product obtained by heating under pressure is lighter in colour and the drying qualities are unaltered.

Dr. E. P. Hedley then read a paper, experimentally illustrated, in which he traced the growth of our knowledge of the discharge through rarefied gases and high vacua from the pioneering researches of Crookes to the counting of the electrons by J. J. Thomson and his collaborators. The question of thermionic conduction due to the emission of electrons from heated metal was then discussed, and it was shown how the theoretical elucidation of Richardson and Langmuir led to the development of the hot kathode Röntgen ray tube at the hands of Dr. Coolidge. The advantages of the new X-ray tubes were discussed and also their uses, together with those of special varieties such as the "kenetron," which serve as thermionic rectifiers, chiefly of high-tension alternating currents.

The important discoveries made in the laboratories of the General Electric Co., of Schenectady were briefly outlined, especially the scientific investigations which led to great improvements in the metal filament lamp, and consequently to the transference of much profitable industry from Europe to America.

Specimens of thermionic rectifiers were displayed which had been lent by the British Thomson-Houston Co., and for many of the experiments thanks are due to the Physics Department of University College, Nottingham.

CHEMICAL ENGINEERING GROUP.

About 150 members attended the Conference on "The Transport and Distribution of Liquids in Chemical Works," held at Newcastle-on-Tyne on December 15. There were two sessions of the Conference, that in the afternoon being presided over by Prof. Henry Louis, who welcomed the group on behalf of the Principal of Armstrong College, Sir Theodore Morison.

The first paper at the afternoon session was by Mr. J. A. Reavell, who discussed the principles of two standard types of the Kestner automatic acid-elevator, the first working intermittently and the second continuously. The Avamore "squeegee" pump was described by Mr. R. A. Pelmore, who claimed that this was the only positive rotary pump which had no high-speed wearing surfaces. Mr. S. J. Tungay read a paper on centrifugal pumps for sulphuric and nitric acids, the great advantages of which are absence of valves and relatively little friction between the moving parts. The author described the Haughton multi-stage or turbine acid pump made of "Ironac," and adduced the results of a number of working tests with sul-

phuric acid of spec. grav. 1·5. He also gave working results for a pump constructed of very high silicon-iron and possessing some novel features, which had been used successfully for nitric acid and mixed acid at Greetland and other explosives factories.

The evening session was presided over by Prof. P. P. Bedson and Mr. George Sisson. A description of the construction and the method of working of the "Marcien" pump was given by Mr. A. A. Stewart, together with a statement of the various purposes to which it is being successfully applied. The pump has no gland of any kind and can be made of almost any material. Mr. W. Hayhurst pressed the claims of ceramic materials for pump construction and then gave an account of the armoured "Ceratherm" centrifugal pump, which possesses only one gland on the suction side, and has high efficiency. The composition of "Ceratherm" was not disclosed, but it is claimed to be very highly resistant to acids, sodium peroxide solution, etc., and to withstand successfully rapid changes in temperature. A comprehensive survey of pumping and elevating plant used in chemical works was given by Mr. J. H. West, and an interesting description of the handling of petroleum in bulk at Thames Haven by Mr. N. A. Anfilogoff. These papers should appear shortly in the "Transactions," and for this reason are but briefly noticed here.

It remains to be mentioned that the exhibition of pumps and elevators held in connexion with the Conference added materially to its success.

MEETINGS OF OTHER SOCIETIES.

THE ROYAL SOCIETY.

At the meeting held on December 4, Sir J. J. Thomson in the chair, papers by Mr. T. R. Merton were communicated "On the Secondary Spectra of Helium" and "On the Spectra of Isotopes." In regard to the latter, the author concludes that spectroscopic measurements seem to provide a favourable method of distinguishing isotopic elements, and that probably the thallium in pitchblende is an isotope of ordinary thallium.

In a paper entitled "A Study of Catalytic Actions at Solid Surfaces," Drs. E. F. Armstrong and T. P. Hilditch show that the catalytic action of metals, like that of enzymes, is reversible. Thus when a mixture of cyclohexanol and methyl cinnamate is heated at 180° C. in presence of nickel, a considerable transference into cyclohexanone and methyl β-phenylpropionate is effected; and dehydrogenation also occurs when hexahydroxylene and dihydropinene mixed with methyl cinnamate are heated at 230° C. in presence of the same catalyst.

THE INSTITUTE OF CHEMISTRY.

The first annual dinner of the Liverpool Section was held at the Midland Adelphi Hotel on December 5, Mr. G. Watson Gray, chairman of the Section, presiding. The guests included Sir Herbert Jackson, President of the Institute, Mr. Alderman W. Muirhead, Mr. R. B. Pilcher, and some ladies. The toast of "Liverpool: Its Industries and Commerce" was given by Mr. John Gray, who, in referring to the heavy chemical industry, remarked that this country had less to fear from foreign competition than from the uncertain position of labour matters at home. Mr. Alderman Muirhead, in reply, suggested the endowment of a chair at the Liverpool University for the purpose of instructing trade union leaders in the principles of political economy. Production is the only road to progress and prosperity; a system of grading workers is necessary, and trade union leaders should recognise that some were able to do more work and better work than others.

The toast of "The Institute" was proposed by Alderman Muirhead and responded to by Sir Herbert Jackson, who congratulated the Liverpool Section—the first to be formed and the first to hold an annual dinner—on its organisation, its activity, and its chairman. He referred to the aims of the Institute, its growth, and the development of its work, especially in the formation of a great professional body composed of trained and competent chemists, and maintaining in the practice of the profession of chemistry the highest integrity and efficiency.

Other toasts given were "The Ladies," by Mr. W. Doran; "The Guests," by Mr. J. Hanley, the Hon. Secretary of the Section; "The Liverpool Section," by Mr. D. Cardwell; and these were responded to by Miss M. Roberts, Mr. R. B. Pilcher, and Mr. Watson Gray, respectively.

ROYAL SOCIETY OF ARTS.

At a meeting held on December 3 a paper entitled "The Seed-Crushing Industry" was read by Mr. J. W. Pearson.

In outlining the history of the development of the industry in this country the author stated that, while there are indications of the existence of oil mills in England in the fifteenth century, the first authentic records of any factory date back to the seventeenth. At first the trade was centred mostly at the principal shipping ports—Hull, London, and Liverpool, but with improvements in shipping facilities the trade gradually extended to the outports. To-day the centres of manufacture are Aberdeen, Bristol, Burntisland, Bridgewater, Colchester, Dundee, Gainsborough, Glasgow, Gloucester, Grimsby, Hertford, Ipswich, Kirkcaldy, Leith, Lincoln, Liverpool, Lynn, Manchester, Rochester, Southampton, Warrington, and Weybridge, all of which are able to put up a very effective competition against Hull and London.

Prior to the outbreak of war the importance of this industry from a national point of view had not been fully realised, but early in the war its importance as a means of supplying glycerin was quickly recognised, as was later on its value as a source of edible oils and cattle cake. The claim of the oil-seed trade to be regarded as a key industry is based on the large quantities of oil required on the one hand in the technical trades, such as soap, paint, and varnish making, and on the other in the edible trades, such as baking, frying, cooking fat, and margarine manufacture. The total consumption of oils for these purposes in Great Britain is estimated at 600,000 tons yearly.

The oil-seeds may be divided into two main groups—(1) those containing 45 per cent. of oil or over, such as groundnut, copra, and palm-kernel; and (2) those containing less than 45 per cent. of oil (such as linseed, cottonseed, and soya). Most of these grow in the Torrid Zone, but the continent of Europe raises considerable quantities of linseed, rapeseed, poppy, and sunflower. As the requirements for oils increase there is little doubt that in years to come, with future scientific developments and treatment, some of the lesser known or more inaccessible oilseeds, such as cohune, coquilla, and coquita nuts will take their place among the important sources of oil supply.

The author sketched the history of the development of the plant used in seed-crushing from the earliest description of an apparatus dating back to about 30 B.C. up to the present time, where a unit of machinery consists of one set of rollers, one kettle with its moulding machine, one battery of four hydraulic presses fitted to take sixteen cakes each, hydraulic pumps, accumulator and paring

table, each unit being worked by a squad of three men and turning out 112 cakes per hour. No system has yet been discovered which will enable the whole process of oil manufacture to be conducted automatically from the cooking kettle to the point of oil expression, and this is the stage where there is much scope for economy in manufacture.

In the other system of treating oil seeds, viz., by chemical extraction, the chief solvents used are petroleum ether, carbon bisulphide, carbon tetrachloride, and trichlorethylene. For a long time the oil obtained by this method was regarded as unsuitable for edible purposes, but the use of purer solvents and improved refining processes has removed this objection. In pre-war days it was generally reckoned that the total manufacturing costs under the extraction process were 50 per cent. greater than those under the hydraulic system.

The consumption of margarine in England has increased three-fold during the war, and the margarine manufacturing plants are now capable of producing over 10,000 tons per week. Before the war the seed-crushing industry was carried out in this country principally for the sake of cake production, but in the last five years numbers of new plants have been erected, of which the major object is the production of oil, particularly for edible purposes. The hardening or hydrogenating process for the conversion of liquid into hard oils normally costs about £5 per ton, and the hard oils generally command in the open market a premium of £10 to £15 per ton over the liquid oils.

The third Trueman Wood lecture was delivered on December 10 by Sir Oliver Lodge, the subject being "Sources of Power, Known and Unknown." The lecturer passed in brief review known sources of power, including solar energy present in sunshine, the internal heat of the earth and the energy of the tides, and the energy of coal. Solar energy could be best utilised by the promotion of agricultural operations. Solar rays falling on barren soil were a reflexion on humanity. The production of power from the tides appeared to offer little prospect commercially. A great degradation and consequent waste of energy necessarily accompanied the employment of all forms of heat engines. Amongst concealed sources of energy the lecturer included the energy of the atom and that of the ether—the latter rather hypothetical, but, if existent, far exceeding in magnitude that of atomic energy, which latter is immense compared with any form of chemical energy, such as that derived from combustion or explosives. The emission of this atomic energy was accompanied by a decrease in the weight of the emitting atom. The emission occurred spontaneously and measurably in the case of radioactive substances. The appearance of quiescence in other cases must not be regarded as symbolical of the absence of atomic energy. Atomic energy was there, but awaited the right stimulus for its exhibition. Cordite or other explosive reveals no trace of its store of energy until appropriately stimulated. In a brief review of the characteristics of the emission of atomic energy the lecturer remarked that helium atoms were emitted from radioactive substances with a velocity sufficient to carry them from London to New York in a quarter of a second, in the absence of obstructions. To some extent these atomic sources of energy are already being utilised. The therapeutic use of radium in the cure of disease is an instance of such utilisation. In the lecturer's opinion the phenomena of vision are attributable to the emission of electrons from the retina, whereby the nerve endings thereat are stimulated. The emission of electrons also finds useful application in the sensitive thermionic valves employed in wireless telephony. What of the future? The lecturer envisaged a world—and possibly at no very distant date—when these atomic sources will be more accessible than at present. At that date energy would be derived from an ounce or two of matter rather than from a thousand tons of coal; the atomic energy contained in 30 grains of matter would, if available, be sufficient to raise a hundred thousand tons through 3,000 ft.

INSTITUTION OF PETROLEUM TECHNOLOGISTS.

At the December meeting a paper on "The Application of Liquid Fuel to Heavy Oil Engines" was read in abstract by Mr. A. J. Wilson.

In this paper the author confined his attention to the heavy oil engine as represented by the two types:—(1) Diesel, or constant-pressure engines, in which the heat of compression alone fires the injected fuel; (2) Semi-Diesel, or constant-volume engines, in which ignition is obtained by the combined effect of compression and the surface heat of a vaporising chamber; and to the liquid fuels for the same. After describing these two types the lecturer dealt with the liquid fuels employed, and the effect of constitution and composition on their efficiency. Specific gravity reveals within limits if an oil is of asphaltic or paraffin base, and whether distillate or not, and, generally speaking, high specific gravity accompanies low calorific value. Viscosity directly affects the thermal efficiency, the more viscous the oil, the lower the thermal efficiency, owing probably to inferior degree of fineness of atomisation. Asphaltum content affects efficiency due to formation of coke, which may attach itself to exhaust valve faces, and gives rise to high exhaust temperatures. Freedom from ash is a necessary factor in these fuels, about 0·06 per cent. being the outside limit for a fuel from petroleum, although a slightly higher percentage is sometimes permissible in the case of tar oils, the ash of which may be of a softer nature. Tar oils require modifications in design, owing to their higher temperature of spontaneous ignition. The methods of handling this class of product were fully dealt with, and the following specification of a suitable tar oil was given:—Specific gravity at 20° C., below 1·10; flash point (open), above 150° F.; coke, below 3 %; ash, below 0·5 %; matter insoluble in benzine, below 0·25 %; total water by volume, below 1.5 %; separated water, nil.

In the discussion the President (Sir F. Black) and Mr. Templeton suggested that the designers of the Diesel type of engine should devise an engine which could be run on varied qualities of residual oils, instead of elaborating the present type, for which the quality of oil is restricted to certain limits.

Mr. Anfilogoff took exception to the loose way in which the term "crude oil" was used by those interested in Diesel engines, and also pointed out that the extended use of gas oil did not help to conserve oil supplies, as its manufacture necessitated the production of what are practically useless residuals. He also pointed out the danger of the hot-bulb ignition system in cases where inflammable vapours are likely to be present.

Dr. Ormandy stated that such danger did not exist, owing to the high temperature of ignition of these vapours, but Mr. Anfilogoff gave instances of fires arising from such causes.

Mr. Challener pointed out that the present type of Crossley heavy-oil engine is able to deal effectively with very heavy residual oils; he contended that the figures of spontaneous ignition temperatures in oxygen are practically valueless in determining the suitability of an oil for heavy oil engines. Further, he stated that in Germany at the present time the use of coal-tar oils for Diesel engine work is deprecated, as they are the cause of many breakdowns.

In his reply Mr. Wilson stated that the two-cycle engine would probably solve the difficulty of the use of any fuel, and also that low-grade petroleum residual oil was better than tar oils for the purpose.

THE FARADAY SOCIETY.

On December 15, 1919, at Burlington House, Mr. A. G. Tarrant presented a paper on the measurement of physical properties at high temperatures. The work described had special reference to refractory materials, of which the properties at high temperatures are little known. Thermal expansion, tensile strength and thermal conductivity were investigated, and the author's experimental methods were described in detail, though no actual results were given. For measuring the thermal expansion, the difference between the expansion of the sample and that of a graphite containing tube was measured by means of a simple form of dilatometer. Heating was carried out in a nichrome-wound furnace. The method is only suitable for works tests where comparative results are required; attempts to obtain absolute values were unsuccessful. Tensile tests were carried out in a carbon spiral furnace at temperatures up to 1800° C. In some cases the strength of "soft-burnt" materials was found to be much greater at high temperatures than at normal temperature, due to the "hard-burn" which the sample received during the test. For the determination of the thermal conductivity of refractory materials several methods were used, but without any considerable degree of success, the chief difficulty being the determination of the temperature of the test piece in contact with the heater. In the discussion which followed particular attention was drawn to the necessity for ensuring uniformity of temperature conditions over the specimens in all tests.

A paper by Lieut. W. A. Macfadyen described attempts to deposit iron, by the electrolytic method, on to steel articles which had become worn in service, with the object of reducing scrap and facilitating repairs. The experiments were carried out under war conditions in France, and led to very successful results for many purposes. At first considerable trouble was experienced through irregularities in the coating caused possibly by the deposition of sediment from the solution during the plating operation. This was ultimately overcome by placing charcoal in the solution. In order to render the coatings suitable for meeting service conditions they were submitted to heat-treatment, consisting of annealing and carburising. Inter-diffusion of the deposit and the steel was found to be complete if the annealing temperature exceeded the A3 point of the iron. With lower temperatures the results were not quite so satisfactory. Case-hardening could be applied to the material with success, but even when this was done, a preliminary annealing about A3 point was recommended to obtain the best results. In the discussion which followed a number of further details of the working of the process was given by various speakers.

In addition to the above papers, a note on the vapour pressure of binary mixtures was presented by Prof. A. W. Porter, while papers on the electrolytic formation of perchlorate (J. G. Williams), the solution theory of steel (E. D. Campbell), the relation between the solubility of solutes and their molecular volumes (S. Horiba), the determination of vapour pressure and some properties of copper ferrocyanide (E. J. Hartung) were taken as read.

On January 14 next, at Burlington House, W., the Society will hold a joint meeting with the Royal Microscopical Society, the Optical Society, the Photomicrographic Society, and the Optical Committee of the British Science Guild on the subject of "The Microscope: Its Design, Construction and Application."

NEWS AND NOTES.

UNITED STATES.

The German Dye Situation.—In an address before the Washington Section of the American Chemical Society on November 25, Dr. C. H. Herty gave impressions of his recent visit to Europe in connexion with the purchase of vat dyes from Germany (this J., 1919, 376 R) and his work for the Reparation Commission in Paris.

Germany is ready to re-capture the world's dye trade and to stifle American competition. The threat to American dye interests lies in the fact that until American manufacturers can meet home requirements, Germany can charge extortionate prices for those dyes which are not manufactured in the United States (*cf.* this J., 1919, 456 R). Germany is now manufacturing dyes on a large scale, and owing to the present low value of the mark will be able to underbid the American dye producer in an open competitive market. The only solution lies in the passing of adequate legislation, including the introduction of a licence system, to protect American manufacturers until they can stand on their own feet. In the course of an interview, Dr. Krell, director of the Badische Co., expressed himself fully confident that the German dye firms would regain their business with America, through the medium of their former agencies. Although German industry is confronted with many handicaps, notably with coal shortage and bad transport, it must not be forgotten that the Rhine will be available for the shipment of dyes to Rotterdam. The German dye manufacturer is strong to-day, his plants are even greater than before the war, the *personnel* is practically intact, large stores of material have accumulated, and he is determined to regain his markets.

Dr. Herty strongly dissents from the views expressed by Mr. Irving H. Keene that the Germans were not manufacturing dyes in sufficient quantities to be a menace to the industry in the United States, and that they would not be able to dump enough dyes and dye materials upon the American market to have any appreciable effect (see this J., 1919, 417 R). Mr. Keene, he stated, has no technical knowledge of dyes or of the dye industry.

Proposed Cotton Research Association.—Inspired by the example set in England, and taking the opportunity offered by the recent World Cotton Conference to call attention to the importance of research in the cotton industry, a committee has been appointed to pave the way for the formation of a Cotton Research Association in the United States. Certain work is already being carried on by the manufacturers' associations, the textile schools, agricultural experiment stations and others, but so far co-operation and co-ordination have been lacking. The first work of the committee will be to select the problems of most pressing importance, ascertain what facilities exist for their study, and prepare a budget which can be presented to those interested in the financial support of the work. When formed it is expected that the American agencies for cotton research will co-operate with those in other countries.

The resolutions relating to research passed by the Committee on Research Reports and Statistics of the World Cotton Conference were:—

(1) This Committee recognises the imperative necessity for all countries where cotton is grown or used to establish research institutions, and urges that such institutions should work in close co-operation with each other, especially in matters of fundamental research.

(2) This committee suggests that steps be taken to investigate in all sections of the cotton trade the most favourable hours of labour, rest pauses,

fatigue and other conditions relative to efficiency and the preservation of the health of the workers.

(3) In view of the fact that it is upon the type and character of the cotton fibre that the results of all subsequent treatments are dependent, and in view also of the present impossibility of referring the commercial varieties to any definite strains, it is considered that the researches of most urgent and fundamental importance should be directed towards obtaining strains of definite types in order to make possible the correlation of the ascertainable characteristics of a fibre with the particular strain —pure or mixed—of which it is a member.

(4) With the increased interest at present taken in research work in the cotton industry, and in order to derive the practical benefit of the work carried on by institutions undertaking research, this committee recommends that the work of such institutions should be brought into close contact with the various branches of the industry by carrying out work so far as is practicable in the factory.

The committee recommends co-operative research in methods of testing fibres, yarns and fabrics with the object of securing, so far as possible, standard international methods, and urges a uniform system of expressing results.

The committee wishes to point out the desirability of undertaking research to establish an international regain for cotton and cotton goods.

This committee suggests to the International Cotton Federation that, at its congresses, the subject of scientific research be given a place on the programme, and that the Federation consider the advisability of extending invitations to cotton research associations and others interested in such work.

The Chemical Warfare Service.—The future of this service is still undecided, but its continuation is now regarded as probable. General Pershing has declared in favour of its retention.

The Printers' Strike in New York.—The publication of many scientific and techical papers has now been suspended for many weeks owing to the printers' strike in New York City. In a number of cases arrangements have been made for the permanent transference of printing and publication to other cities.

Tin in the U.S.A. in 1918.—The tin imported in 1918 as metal and metal in concentrate reached the record quantity of 82,854 short tons, an increase of nearly 5,000 tons over imports in 1917. The metal imported and entered for consumption was 71,254 short tons, and the tin produced by the domestic smelters, almost wholly from Bolivian concentrates, was 10,284 tons. The total supply of new tin was therefore 81,538 tons. The world's output of tin in 1918 was about 144,000 short tons, so the tin available for consumption in the United States amounted to 57 per cent. of the world's output. The home production, obtained principally from Alaska, amounted only to 68 short tons of metal. Development is taking place of some smaller deposits found in various States. There was a sharp increase in the amount smelted, which rose to 10,284 short tons of metal, of which 9934 tons was made by the American Smelting and Refining Co. Part of its product is marketed as electrolytic tin, assaying 99·9 per cent. or more, and part as smelter tin assaying 99·3 per cent. or more. The Williams Harvey Corporation commenced smelting tin in November at its plant on Jamaica Bay, Brooklyn, N.Y., and the Andes Electin Co., of New York City, and the Eastern Metal and Refining Co., of Boston, Mass., also produced some tin. The average price of spot Straits tin in New York was 86·8 cents a pound, as compared with 61·65 cents for 1917, and in London the average price was £329 11s. per ton of 2240 lb.—(*U.S. Geol. Survey, Sept.* 9, 1919.)

Discovery of High-Grade Silica Sand in Louisiana.—Deposits of high-grade silica sand underlaid by large beds of glass sand, and estimated to contain about 18,000,000 yards of sand and gravel, have been discovered near Munroe, Louisiana. (*Bd. of Trade J., Nov.* 13, 1919.)

Sulphur Deposits in Alaska.—Deposits of sulphur of the type called *solfataras* occur in many of the Aleutian Islands. One deposit is located in the crater of Makushin Volcano on Unalaska Island, where it is estimated that from 10,000 to 15,000 tons of sulphur can be mined. Another deposit covering from 15 to 20 acres, and containing about 1,200 tons per acre, occurs on Akun Island, while a third deposit is located on Stepovak Bay. (*Bd. of Trade J., Nov.* 13, 1919.)

AUSTRALIA.

Tanning Barks in Western Australia.—A recent publication issued by the Western Australia Forest Department points out that the forests of Western Australia are rich in timbers, leaves, and barks containing tannin. Every member of the eucalypt family holds a certain percentage of tannin, but in only some of them is the proportion sufficiently high to justify the making of extracts from the bark, wood, or leaves. With the exception of mallet bark the percentage of tannin derived from West Australian eucalypts is, as a rule, under twenty. Certain of the mangroves in the northern rivers show a higher percentage, but so far these have only been used locally for tanning purposes. The following list gives the results of analyses for tannin of the barks of certain Western Australian trees:—

Local names.	Tannin content. per cent.
Marri (Redgum), "kino"	68
Blue Leaf Mallet Bark	47
Silver Mallet Bark	45
Brown Mallet Bark	41
Swamp Mallet Bark	36
Gimlet-wood Bark	26
Spotted Gum Bark	24
Blackbutt Bark	19
Black Mangrove Bark	46
Red Mangrove Bark	44

Although valuable for its wood, it is likely that marri or redgum (*Eucalyptus calophylla*) will in the near future depend for its commercial importance mainly upon its kino or gum. This tree is unique of its kind, so far as its kino is concerned. The gum exudes in large quantities and contains a very large percentage of tannin. The objection to its use hitherto has been its red colour, but investigations are in progress with a view to the elimination of this objectionable feature, and if these are successful the kino of the marri of Western Australia will become one of the most valuable products of the State's forests. The tanning material is collected by scraping the trunk of the tree and so removing the kino and kino-impregnated bark. This operation does not injure the tree, and may be repeated at intervals of a few years. It is this perennial yield of gum without destruction of the tree that promises in the future, when means have been found of eliminating the red colour, to be the principal factor in the establishment of a large and stable "kino" industry.

Mallet bark is peculiar to Western Australia and is one of the world's largest yielders of tannin. To this quality is due the fact that the tree has entirely disappeared from some quarters, while in others only seedlings and saplings are visible. Up to 1903 mallet bark was appreciated only in the districts where it existed. In that year the first export was made to the value of £859. Within two years the quality of the bark had been recognised abroad, and a phenomenal demand for it set in, and

in 1905 the exports rose to the value of £154,087. Since then exports have gradually fallen, until in 1913 they amounted to £47,477, and in 1918 to £16,886. Measures are in hand for the regeneration of the destroyed areas and for the planting of new ones. Germany was the largest customer for the mallet bark, which, after treatment, was sent out all over the world, including Australia, in the form of extracts.—(*Austral. Forestry J., July,* 1919.)

Iron and Coal in South Australia.—It is anticipated that not less than 60,000,000 tons of iron ore will be proved at Iron Knob in South Australia. These deposits, which were first worked in 1899, have yielded 1,820,341 tons of ore, and the quality, size, and accessibility of the ore bodies are such as to make this field superior to all other Australian sources of ore suitable for large scale steel production. The larger outcrop extends over about 52 acres. From a smaller deposit in the same region 700,000 tons of hematite containing 68 per cent. iron has already been obtained. The best coal deposits in the State occur at Leigh Creek. The coal is of the "sub-bituminous" class. Hitherto transport costs have militated against its use in the manufacture of briquettes, for steam-raising purposes and for the generation of producer gas, applications for which the coal has been found to be suitable. A bed, 21·5 ft. thick, has recently been located at a depth of 711 ft., and the average composition of the best samples (air dried) was:—Moisture at 105° C., 16·52%; volatile matter, 29·87%; fixed carbon, 41·42%; ash, 12·18%. The calculated calorific value of an air-dried sample was 10,272 B.Th.U. per lb., which may be compared with that of small coal from Newcastle, New South Wales, averaging from 13,000 to 13,500 B.Th.U. per lb. Another seam has recently been struck at a depth of 882½ ft.—(*Bd. of Trade J., Nov.* 13, 1919.)

NEW ZEALAND.

Development Schemes.—A Government Industries Committee has recommended the establishment of a Board of Science and Industry to co-operate with universities and scientific institutions in the organisation and promotion of industrial and scientific research; to award scholarships, bonuses and prizes; and to advise producers as to the results of investigations.

The Committee also recommends the nationalisation of the coal measures of the Dominion and the purchase by the State of privately-owned mines and measures at a valuation; the equipment by the Government of gold-prospecting parties to work under the direction of the Geological Survey Department; and the provision by the State of smelting facilities for the recovery of base metals, for at present only gold and silver are extracted from the concentrates. As there is no well-established firm engaged in the manufacture of iron and steel, it is recommended that the value of all iron deposits should be investigated by an expert metallurgist; that the neighbourhood of the Parapara iron deposits should be prospected systematically for coal; and that the export of scrap iron and steel should be prohibited.

Although some millions of gallons of oil have been obtained from borings in several parts of the Dominion, the results so far have been disappointing, and private enterprise has nearly exhausted its resources—indeed the Government is subsidising one company in Taranaki in putting down one of the deepest bores yet made in New Zealand. The Committee urges the Government to consider seriously the offer of the Anglo-Persian Oil Co. to co-operate with the Government in the search for oil and in the production, refining and marketing of it, if found. It is recommended, further, that encouragement be given to the shale oil industry, which has been suspended for several years.—(*Bd. of Trade, J., Nov.* 20, 1919.)

BRITISH INDIA.

Indian Cotton.—The final estimate of the production of cotton in India in 1918–19, as published in the *Supplement to the Gazette of India* for November 1 is 3,671,000 bales of 400 lb. each, from an area of 20,497,000 acres. For the preceding year the official estimate was 4,065,000 bales from an area of 25,298,000 acres, but the trade estimate was 4,204,000 bales, of which 2,044,000 was consumed in Indian mills, 1,410,000 exported, and 750,000 consumed outside the factories. In both years the yield per acre was very low, being 71·6 lb. per acre in 1918–19 and 64·0 in 1917–18, as compared with 84, the mean of the last 10 years. For the year 1919–20 a much larger crop is expected. In the tracts from which returns have been obtained up to date the area under cotton is 19 per cent. larger than at the same time last year, and the condition of the crops is on the whole good.

Japan is by far the greatest importer of Indian cotton, after which came, before the war, Germany, Belgium, Italy, Austria-Hungary, France, and the United Kingdom, in the order named. During the war Japan took, in addition to its previous imports, most of that formerly sent to the enemy countries, but Italy also about doubled her imports. But little Indian cotton is imported into England on account of its short staple. Its adulteration also prevents it use for the manufacture of high-class fabrics, and the watering of the cotton is specially injurious. In Appendix B of the Report of the Indian Industrial Commission it is stated that "the watering of unginned cotton is not practised on a relatively large scale, and can be put a stop to by the action of the ginners. The watering of ginned cotton by the balers is, however, a much bigger matter; it is done on a large scale and in a thoroughly organised manner, pipes and hoses being used for that purpose in many press compounds, especially in Berar." The fraudulent increase of weight is not the greatest of the evils produced by this practice. Every year there are a number of destructive fires in the cotton green at Bombay in consequence of the self-heating of this wet cotton, although it is thought that some of these fires are due to deliberate incendiarism. Moreover, the quality of the wetted cotton is seriously impaired.

Last year a committee was appointed to inquire into the possibilities of improving the quality and quantity of the Indian cotton crop. That there are possibilities as regards quantity is shown by the fact that the average yield of ginned cotton per acre is 200 lb. in America and 450 lb. in Egypt, but at the same time it must be borne in mind that much of the Indian cotton is grown on comparatively poor soil.

JAPAN.

Petroleum Production.—The production of petroleum in Japan has been decreasing yearly since 1914, while the domestic demand has increased. In 1914 the total Japanese production was 115,849,104 galls.; in 1915, 127,368,528 galls.; in 1916, 127,086,624 galls.; and in 1917, 121,790,640 galls. This decrease is attributed partly to the cessation of imports of iron pipe for the equipment of the wells, and partly to the difficulty experienced in locating new sources of supply.—(*Indian and Eastern Engineer, Nov. 1919.*)

Production of Pyrethrum Flowers.—The flowers of the biennial plant *Chrysanthemum partherium* constitute a very valuable insecticide, being, when dried, harmless to human beings and the higher animals, but acting as a deadly poison to insects.

The production of dried pyrethrum flowers and the manufacture of insect powder in Japan have increased during the war, in fact during the past four years practically the whole world's supply came from this source. The production increased from 1100 tons in 1915 to 2200 tons in 1916. During the period 1913 to 1918 the export of dried flowers and insect powders also increased, as is shown by the following figures. In 1915 Japan exported 175 tons flowers and 105 tons powder; in 1918, 1612 tons flowers and 408 tons powder. As a result of a large falling-off of production during 1919 there is at present a considerable shortage, and prices have been gradually forced up; there is, moreover, little hope of a decline in these prices, since many farmers in Japan formerly producing pyrethrum are turning to other crops.—(*U.S. Com. Rep., Nov.* 10, 1919.)

SOUTH AFRICA.

Prospects of the Cotton Industry.—Mr. A. Canham, the Acting Trade Commissioner for the Union, who has recently been visiting Lancashire with Mr. W. H. Scherflius, the chief of the Cotton and Tobacco Division of the South African Department of Agriculture, states that the outlook for cotton growing in South Africa appeared to be very bright in view of the high prices realised by raw cotton. South African cotton, said Mr. Canham, commands a higher price than middling American. Hitherto the industry has suffered on account of the indifference of the growers with regard to grading, but this is now receiving more attention. The present year's crop is about 800,000 lb., *i.e.*, 2,000 bales of 400 lb. each. Last year's crop was only half this amount, and the increase is due rather to a greater acreage having been planted than to better climatic conditions. About 500,000 lb. was grown in Natal and Zululand, and 300,000 lb. in the Rustenburg district of the Transvaal. There is a large area suitable for cotton growing, and as the picking can be performed by native women and children the output is likely to increase steadily, particularly if prices remain high. With the exception of a small quantity required for local consumption, practically the whole of the crop will be disposed of in Lancashire. An important point, and one which may determine the whole future of the industry, is seed selection. Cotton growing being still in its infancy in South Africa, by proper attention to seed selection it will be possible to secure the growth of the best types of plant and those which best resist insect pests. Stringent precautions are taken against the importation of seed from infected areas. The need for a larger staff of agricultural experts to guide growers is recognised. A considerable proportion of this year's output is already in London, and has been graded for the first time in the history of the industry.—(*Official.*)

FRANCE.

Industrial Notes.—*Chemical Industry.*—There is a great shortage of chemical products on the French market, and importations from England are materialising but slowly. Astonishment is expressed at the fact that German finished chemical products seem to find readier access to Great Britain than the French products, and this is causing French producers to attempt to secure a hold on the German market. A great increase is noticeable in the price of arsenic, which has suddenly risen from 200 to 275 francs per 100 kilo., and the demand continues great. The shortage of British chemicals, and of barium salts in particular, is handicapping the manufacture of hydrogen peroxide, which is much used in the textile industry, and which now commands a high price. The price of barium chloride has risen from 75 to 90 francs in less than a fortnight.

Fuel.—The fuel oil "mazout" has been tried with success by the P.L.M. Railway Co. on a locomotive adapted for the purpose. The company has therefore decided to convert a first batch of 200 engines at the rate of two engines a day. Oil tanks are to be erected at various stations on the line.

Metallurgy.—The outstanding feature at the moment is the intense activity prevailing not in the factories, but in the different companies which control them. As previously described, these companies are enlarging their spheres of influence and their financial capacity. Further impetus has been imparted to this movement by the recent sales in Metz of the sequestrated German undertakings, and also by the sanction given by the Luxembourg Legislative Chamber to liquidate all German property situated in the Grand Duchy. These events have given rise to a redistribution of the various works and to the formation of new combinations which, as in the case of the Meurthe and Moselle firms, show a tendency to allocate to each factory a special line of manufacture. The big "combines" may be briefly classified as follows:—

(1) *La Société Lorraine des Aciéries de Roubas,* which operates chiefly in Alsace-Lorraine. Its headquarters is at Roubas (Moselle), and it commands a capital of 150 million francs. (2) *La Société Métallurgique de Kuntange,* which is concerned with mining and metallurgical developments in the recovered provinces. Its head office is in Paris (16, Bd., Malesherbes), and its capital 75 million francs. (3) *La Société Métallurgique des Terres-Rouges* controls all the factories of Gelsenkirchen in Lorraine, in the Grand Duchy, and on the left bank of the Rhine. Its capital is 100 million francs, and the head office at Luxembourg. (4) *Aciéries de la Marine* is interested in (1), and is shortly associating with the *Aciéries de Micheville* to exercise a joint control of the works of *Homécourt* and *Micheville.* (5) *Les Aciéries de Longwy* is reported to have made an agreement with Rochling to share in the production of the Woelklingen works near Saarbrück. (6) *Hauts-furneaux de Pont-à-Mousson* is concerned with the blast furnaces at Pont-à-Mousson; it is war-scarred, but now fully convalescent, and likely soon to recover its former activity.

General.—On the whole the industrial and economic situation in France may be considered hopeful. The results of the General Election have had a steadying effect, and the introduction of new blood into the Chamber and the Cabinet is likely to lead to further general improvement. The Government and the new members stand for a great constructive and national policy to be prosecuted in a sound, public-spirited and business-like way.

Attention must be drawn to the formation of the *Confédération Générale de la production française*—briefly referred to as the C.G.P.—which was called into being by the Government, but is quite independent. It is a sort of advisory body composed of leading representatives of all the chief industries and public utility services. Its essential aim is "to assist the development of the national resources of France and of its powers of production and exportation, to co-ordinate the efforts of the syndicates and various professional associations, and to effect the conbination of producers in defence of their interests."

Preservation of Explosives.—The Government has decided to adopt the process suggested by M. Lefèvre for preserving the huge stocks of nitrocellulose explosives in the country, which are valued at 28 to 30 million francs. The plan consists in submerging them in cold water, to wit, the glacier-fed lakes of the Pyrenees. It is stated that such immersion in no way affects the stability of the explosives, and that, in fact, their normal life of 10—15 years will be prolonged to 50 or 60.—(*La Nature, Nov.* 8, 1919.)

GENERAL.

Ramsay Memorial Fund.—This fund was initiated shortly after the death of Sir William Ramsay in 1916 with the object of perpetuating his memory by the establishment of scholarships, fellowships, laboratories, or other means of assisting in the development of chemical science. The decision of the Executive Committee to found and maintain a School of Chemical Engineering in connexion with University College, London, has already received mention in these columns, and the further project of establishing Research Fellowships, to be tenable wherever the necessary facilities are available, has now been taken definitely in hand. As a part of this scheme it is proposed to found special fellowships that may be held by Frenchmen in any approved University or Technical College in the British Empire, and to this end the Executive Committee is inviting donations, it being understood that money subscribed in America shall be earmarked for the provision of fellowships to be held by Frenchmen in the United States. As full particulars are given in a special pamphlet enclosed in this issue of the "Journal," it is unnecessary here to do more than emphasise the great value of the scheme for the promotion of chemistry and of international goodwill, and to ask our members and readers to pay heed to the appeal in the manner desired by the Executive Committee.

Memorials to the Late Lieut.-Col. E. F. Harrison.—Early in the present year an appeal was made through the Chemical Warfare Department to colleagues and friends of the late Col. Harrison to contribute to a memorial fund for the purposes of presenting a bust or medallion to a scientific institution, and of instituting a medal, prize, or scholarship to be awarded to a young chemist of outstanding ability. As Harrison had many associations with pharmaceutical chemistry, it is now proposed that an additional fund be raised, under the joint auspices of the Pharmaceutical Society and the Pharmaceutical Conference, with the object of adding to the value of the prize or scholarship which formed part of the first scheme. Contributions to this fund should be sent to the Honorary Treasurer, Harrison Memorial Fund, 17, Bloomsbury Square, W.C.

National Association of Industrial Chemists.—At a recent meeting of the Executive Council a further increase in membership was reported. The Association has now been registered under the Trade Union Act, and is thus the only body representing analytical chemists in the United Kingdom which is so registered. With the new powers thus granted to it, the Association anticipates a considerable increase in its influence and in its ability to assist the economic condition and professional status of its members. A full-time assistant-secretary has recently been appointed.

Over a hundred members attended the annual dinner of the Sheffield Section, when the chairman, Mr. A. C. J. Charlier, commented on the omission of all chemists, engineers, technical managers, inspectors and supervisors from the joint councils formed under the Whitley scheme, and urged the necessity for all such men to federate in order to secure adequate representation on these councils. The Birmingham Section also held a successful annual dinner.

Special arrangements are being made to give isolated members a fitting share in the management of the Association. The subscription rate of one guinea for full members and half a guinea for associates is to be maintained. Further particulars can be obtained from the Secretary, The White Building, Sheffield.

Industrial Uses of Manjak in Trinidad.—Manjak is a mineral resembling asphalt in chemical composition; it is almost a pure bitumen, containing 80—90 per cent. of carbon, hydrogen, and a small amount of sulphur. It melts above 204° C. (asphalt 38° C.). The principal deposits occur in Trinidad, about three miles from San Fernando, as long seams between layers of clay; mining operations are as yet only in an experimental stage. The quantity exported is at the rate of about 50 tons per annum, chiefly to the United States.

Manjak is finding an increasing number of uses in Trinidad. Boiled with oil and applied in a liquid state it affords a tough, unbreakable, rubber-like protective coating, impervious to both air and water. It is much used in connexion with rotary drilling for oil, being employed to fill the joints of the pipes between casing-threads and drill stem-threads, for which purpose it is much superior to white lead or any substance previously used. Its possible applications are being investigated by the Government of Trinidad. It possesses lubricating properties, and as a paint efficiently protects iron and steel goods when immersed in sea water. It is a good insulator, and is especially valuable as roofing material in tropical climates. Should business conditions warrant it, mining operations at present confined to the Trinidad-Tarouba Oil Development Co. of San Fernando could be greatly extended. The export of crude manjak at the prevailing price of $35 per ton is not a commercial proposition, but good prices are commanded by marketing manjak compounded with mineral oil. Experiments are now being undertaken to determine whether American oils are more economical and useful for mixing purposes than Trinidad oils.—(*U.S. Com. Rep., Oct. 27,* 1919. *See also Report by Trinidad Government, Geol. Council Paper,* No. 3, 1903.)

PERSONALIA.

The death is announced of Prof. A. Werner, professor of chemistry in Zürich University and Nobel prizeman for Chemistry in 1913.

Prof. Maurice Nicoll, of the Pasteur Institute, Paris, has been appointed Harben lecturer for 1920 by the Council of the Royal Institute of Public Health.

Prof. C. H. Desch, professor of metallurgy in the Royal Technical College, Glasgow, has been appointed to the chair of metallurgy in the University of Sheffield, in succession to Prof. J. O. Arnold.

Dr. E. Newbery, formerly lecturer in electrochemistry at Manchester University, has recently taken up his duties as professor of physical chemistry in the University of Cape Town, South Africa.

Mr. Richard B. Moore, who until recently was working at the Experiment Station, Golden, Colorado, has been appointed to succeed Dr. C. L. Parsons as Chief Chemist to the Bureau of Mines, Washington.

Instruction in chemistry at the University of Strasbourg will be in charge of M. Hackspill (general chemistry) and M. Gault (organic chemistry), who will also jointly undertake instruction in applied chemistry.

Sir Richard Redmayne, who has been Chief Inspector of Mines since 1908, has resigned this post in order to devote himself to his work as chairman of the Imperial Mineral Resources Bureau and to engage in private practice. In his stead the Home Secretary has appointed Mr. William Walker, who has been acting as Chief Inspector of Mines since 1916.

PARLIAMENTARY NEWS.

HOUSE OF COMMONS.

Ferro-Alloys.

Mr. T. Griffiths asked the President of the Board of Trade if he would state the reason for prohibiting the importation of ferro-tungsten and for differentiating between that alloy and ferro-chrome.

Sir A. Geddes, in reply, said that the importation of ferro-tungsten and of tungsten powder had been prohibited because of their vital importance in the manufacture of high-speed steel for the engineering industries, and because we were formerly entirely dependent upon Germany for their supply. Although the Government recognises the importance of ferro-chrome, the case for special treatment is less strong. The difficulties of British manufacturers of this product are understood to be mainly due to the existence of large stocks in this country.—(Dec. 8.)

Fertilisers.

The Parliamentary Secretary to the Board of Agriculture informed Sir N. Griffiths that no sulphate of ammonia, ground basic slag or raw slag, or superphosphate is being imported from Germany. The maximum prices for basic slag (in the sale of which the Government has no financial interest) range from 62s. per ton for slag containing 12—14 per cent. of total phosphates to 102s. per ton when that content reaches 42—44 per cent. It has not been possible to fix a uniform delivered price for superphosphate owing to the varying cost of importing phosphate rock, but during the 1918–19 season phosphate rock and other materials were sold to superphosphate makers at less than market prices. This assistance has been discontinued. The present quotations for 30 per cent. superphosphate are from £7 5s. to £7 7s. 6d. per ton, free on rail. (For maximum prices of ammonium sulphate see this J., 1919, 338 R).

In reply to Mr. Hohler, Mr. Hope stated that the Ministry of Munitions does not control the supply of the three above-mentioned fertilisers. The Ministry has never traded in superphosphates or basic slag, but at the date of the armistice it had small stocks of sulphate of ammonia, which have since been sold.—(Dec. 8.)

Mr. J. Hope informed Mr. Hohler that the Ministry of Munitions had made no profit on its transactions in phosphate rock, pyrites or sulphate of ammonia.—(Dec. 17.)

Storage of Petroleum.

Sir H. Greenwood, answering Sir W. Seager, said that the need of adequate storage facilities for petroleum is fully realised. A considerable amount of tankage has been erected or is projected both on Government and private account, and the position will be kept carefully under review.—(Dec. 9.)

Oil Cake.

Sir N. Griffiths asked the Food Controller if he were aware that oil cake has recently been contracted forward from the mills at £10 per ton, and is now being retailed at £22—£28 per ton. Mr. McCurdy replied that the Food Controller had no knowledge of any such sales. Palm kernel and rape cakes have been sold at low prices, but farmers appear unwilling to purchase, preferring linseed and cottonseed cakes, which fetch about £25 and £19—£20 per ton, respectively, ex mill. In reply to supplementary questions, Mr. McCurdy said he had no information that the increase in price of oil cake was largely due to the restriction of the sales of palm kernels to a ring of home manufacturers; the present maximum prices for oil cakes were fixed in accordance with the prices in the countries of origin of the seeds from which they are manufactured.—(Dec. 9.)

Anglo-Persian Oil Co.—The Scottish Oilfields.

On the Report stage of the resolution authorising the expenditure by the Government of £2,050,000 on the acquisition of new ordinary shares in the Anglo-Persian Oil Co., the Financial Secretary to the Treasury (Mr. Baldwin) emphasised the desirability of the Government retaining control, through its shareholdings, of the great oilfields in Persia. There was every prospect of the investment proving very remunerative. Attention was drawn by Sir J. D. Rees to the necessity of securing supplies of fuel oil for the Navy and to the value of the investment as a means of furthering British interests in Persia. The motion to agree with the resolution was opposed by Sir F. Banbury on the ground that the Government as a matter of principle should not invest money in such companies. The Resolution was agreed to, and the Bill giving effect to the proposed purchase was accordingly presented and read a first time.—(Dec. 11.) (*cf.* this J., 1919, 461 R, 464 R.)

On the motion for the Second Reading, Mr. Adamson referred to the interest acquired by the company in the Scottish oilfields, and pointed out that the responsibility devolved upon the Government of settling the claims of the miners in those fields. During the later years of the war, when the companies were prospering, the shale miners were refused an increase in wages because, by agreement, these were regulated by those paid in the coal-mining industry. When, however, the coal-miners' wages were increased by 2s. a day and their working hours reduced, under the Sankey award, the shale workers were told that that award applied only to coal-mining, and that the serious fall in the price of oil rendered impossible any increase in pay. In his reply on the debate, Mr. Baldwin said that compared with the position before and during the war, the shale industry in Scotland is in a very parlous condition, so parlous that private companies could not carry it on in the future. The Anglo-Persian Oil Co. was acquiring unused refineries at a price far below that necessary to erect new ones, and it was hoped that the company would be able to do what the small companies could not do, *viz.*, carry the shale industry on its back. In the New Year there is to be a meeting of representatives of the workers and the company to thresh out the questions of wages and hours of labour. (See this J., 1919, 277 R, 358 R, 461 R.) The Bill was read a second time.—(Dec. 12.)

Pulverised Coal.

Sir A. Geddes, in reply to Sir A. Feil, stated that considerable developments in the utilisation of pulverised coal for smelting and power purposes were taking place in this country as well as in the United States, but he could not say whether a saving of 25 to 30 per cent. was effected by its use. The Government is having a great many observations made, and action will be taken as soon as sufficient information has been obtained.—(Dec. 15.)

Industrial Alcohol.

Asked by Mr. R. McNeill if it was the intention of the Government to carry out the recommendations contained in the Report of the Committee on Industrial Alcohol received last June, Mr. A. J. Balfour intimated that these recommendations have been considered by the Department of Scientific and Industrial Research, and that he was taking preliminary steps, in consultation with the Director of Fuel Research, to enable the Department to deal with the alcohol question in an effective manner.—(Dec. 17.)

LEGAL INTELLIGENCE.

CUSTOMS SEIZURE OF PYROGALLIC ACID. *Attorney-General* v. *Brown* (see also this J., 1919, 379 R, 399 R, 415 R, under *Brown and Forth v. Buckley*).

This case was heard in the King's Bench Division before Mr. Justice Sankey on November 27, 28, and December 17.

The Attorney-General, Sir Gordon Hewart, for the Crown, contended that, by Order in Council, the Crown, through its responsible Ministers, had the right to stop the importation of all classes of goods. Replying to the Judge, who remarked that the argument was a little astonishing, Sir Gordon Hewart said that his Lordship was imagining a hypothetical extreme exercise of power. He submitted that a general power to prohibit importation was vested in the Executive, to be exercised in times of emergency. His Lordship pointed out that Section 43 of the Customs Consolidation Act did not contain any reference to "times of emergency." The Attorney-General concurred, and proceeded to comment on the value of pyrogallic acid in aerial photography, stating that it could be used for the production of poison gas, and that it belonged to the same family as picric acid, the explosive. His Lordship reserved judgment.

On December 17, Mr. Justice Sankey delivered his considered judgment. After reviewing the facts and arguments, his Lordship said that the system of prohibiting imports by Proclamation had sprung up during the war and the Proclamation involved in this case was the thirty-second of the kind. During the war practices were pursued which could not be tolerated in peace. The case turned on the construction of Section 43 of the Customs Consolidation Act, 1876, and the point was whether the argument of the Attorney-General that the executive had absolute power to prevent imports was correct or whether the narrower construction contended for by defendant was a correct one.

His Lordship, having recapitulated the circumstances leading up to the passing of the Act, continued: "Could Parliament have intended at the moment of the birth of Free Trade to confer an absolute power of prohibiting the import of any article, and to do so by the addition of a few words at the end of a category of particular goods? There would appear to be every reason why they should not do so and no reason why they should. If Parliament had wanted to confer power to prohibit importation of all goods they need not have used any particulars words, but might have said generally that the importation of any goods might be prohibited." For these reasons he was of opinion that the *ejusdem generis* rule must be applied to the construction of Section 43, that the general words must be restricted to the meaning of the particulars words, and that the words "any other goods" meant goods of the class of arms, ammunition and gunpowder. The Attorney-General's contention that pyrogallic acid was of the same class of goods as arms, ammunition and gunpowder appeared to him untenable, for it was hard to conceive any article that was not used in modern warfare. In so far as it was a question of fact, he found that pyrogallic acid was not of the same class as the articles set out in Section 43.

"I have come to the conclusion that His Majesty had no power to make the Proclamation in question, and that it is illegal and invalid."

Judgment was accordingly given against the Crown and for the defendant, with costs. Leave to appeal was granted on terms.

PHYTOL CHEMICAL CO., LTD.

In the Chancery Division, on November 28, Mr. Justice Astbury made an order confirming a special resolution passed by this company to alter its memorandum of association so that it may carry on the business of manufacturing disinfectants, sheep dips, chemicals, etc., in addition to trading in them.

COLNBROOK CHEMICAL AND EXPLOSIVES CO., LTD.

The statutory first meeting of creditors and shareholders was held before the Official Receiver on November 25, when it was resolved to leave the liquidation in his hands, assisted by a committee of inspection.

The statement of affairs shows total liabilities £95,716, of which £48,886 is unsecured, and assets £9927, whilst the total deficiency as regards the shareholders is £54,464. The company was registered in July, 1915, with a nominal capital of £21,000, to carry on business as manufacturers of guncotton, explosives, and munitions of war; its primary object was to acquire from O. R. Mounsey the benefit of a contract with the War Office for the supply of 200 tons of guncotton and to carry out a contract with the representatives of the Belgian Government for the supply of a minimum quantity of 300 tons of guncotton. The company was promoted by Mounsey, who, in consideration of the assignment of the former contract to the company, received £1,430 and 20,000 management shares of 1s. each.

The directors ascribe the failure to various causes, including incorrect estimates of the company's engineers, late delivery of machinery, and further capital expenditure on plant required to meet the demands of the Ministry of Munitions.

GOVERNMENT ORDERS AND NOTICES.

PROHIBITED EXPORTS.

By an Order in Council of December 16, the following goods were deleted from List "A" of Prohibited Exports:—Pea flour and meal; cocoa butter (from List "B"); cocoa husks, cocoa shells; oleaginous kernels, nuts, seeds, and products of all kinds, except castor seed; soya bean, cake, and meal; meat meal; gram or dhol; millet.

In addition to the above, the Board of Trade has announced the removal from List "A" of mica blocks, mica sheets, and mica splittings, as from December 18.

The following items have been added to List "A":—Benzol and its compounds and preparations; dimethylaniline; meta-cresol; methylaniline; para-cresol; copra; cotton seed; groundnuts; linseed; palm kernels; soya bean, cake, meal and flour.

INDUSTRIAL EXPLOSIVES.—The present Open General Licence for the export of explosives etc. has been withdrawn and a new one issued for the export of industrial explosives and of munitions for smooth-bore guns to:—British and French Possessions and Protectorates, the United States, South America, Japan and Korea, Asiatic Russia, France, Belgium, Spain, Portugal, Greece, Italy, Holland, Switzerland, Serbia, Rumania, Norway, Sweden, and Denmark. Export permitted under this Open General Licence to certain destinations in Africa is subject to certain provisions of the Arms Convention which was signed by the Allied and Associated Powers on September 10, with the main object of preventing the dispersal of stocks of arms and ammunition which are at present accumulated. ("Treaty Series, No. 12 (1919) of the Foreign Office." Cmd. 414, price 3d.)

NEW ORDER.—The Horsehides (Decontrol) Order, 1917. Army Council, Dec. 9.

NOTIFICATION OF EPITHELIOMATOUS AND CHROME ULCERATION.

The Home Secretary has made an Order enacting the compulsory notification of (*a*) epitheliomatous ulceration (due to tar, pitch, bitumen, mineral oil, paraffin, etc.), and (*b*) chrome ulceration (due to chromic acid and bichromates, etc.). Nov. 28, 1919.

OFFICIAL TRADE INTELLIGENCE.

(*From the Board of Trade Journal for Dec.* 11, 18.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W. 1, from firms, agents, or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the department mentioned and quoting the specific reference number.

Locality of Firm or Agent.	Materials.	Reference Number.
Australia ..	Druggists' sundries	*58 7,44
" ..	Aluminium-ware, perfumery, porcelain, crockery	*35/7/27
British India ..	Paints	1182
British W. Indies	Glass and chinaware	1192
British W. Indies and Venezuela	Soap	1194
Canada	Drug specialities, soap dyes,	1185
" ..	Perfumery, soap	1241
" ..	Galvanised crucible steel strand wire	†
" ..	Raw material for perfumes ..	†
" ..	Dyes	†
Fiji Islands ..	China, glass, drugs, perfumes, galvanised iron	1198
Malta	Leather	1199
South Africa ..	Druggists' sundries, patent medicines	1189
" (Durban) .	Asphalt, flux (tender for, Jan. 28, 1920)	—
Belgium ..	Sugar	1203
" ..	Rubber tubing for Westinghouse brakes	1207
" ..	Paper	1254
" ..	Metals, tinplate, machine oils, chemicals, medicines, oils, perfumes, greases, soap	‡11761 8T&R
Czecho-Slovakia	Asbestos, mica and technical rubber goods	1253
Denmark ..	Drugs, waxes, essential oils	1208
France	Boot leather	1214
Germany (Frankfort)	Chemicals, drugs, fats, oils ores, metals, hides, skins ..	1260
" (Cologne)	Soap	1261
Jugo-Slavia ..	Drugs, edible and lubricating oils, chemicals, fertilisers, extracts, copper sulphate (goods in demand)	—
Poland	Porcelainware	1220
"	Tallow, lard, grease	1266
Spain	Patent pharmaceutical products	1226
Morocco.. ..	Ceresine, ozokerit, carnauba wax, turpentine, turpentine substitute	1270
" ..	Chemicals, tinplate, glass, china	1271
Brazil	Drugs, cement, tinplate, galvanised iron	1233
"	Plain and decorated tiles, faience tiles, earthenware, galvanised iron tubes.. ..	1235
Venezuela ..	Window glass, pottery.. ..	1275

*The Official Secretary, Commercial Information Bureau, Australia House, Strand, W.C. 2.

†The Canadian Government Trade Commissioner, 73, Basinghall Street, E.C. 2.

‡Belgian Trade and Reconstruction Section, Department of Overseas Trade, 35, Old Queen Street, S.W. 1.

MARKETS SOUGHT.

A firm in Argentina able to export hides of all descriptions and quebracho extract wishes to get into touch with importers in the U.K. [1232.]

TARIFF, CUSTOMS, EXCISE.

Australia.—The export of animal fertilisers, superphosphates and raw materials for the manufacture thereof is prohibited save with the consent of the Minister for Trade and Customs, as from October 1.

Austria.—Among the articles upon which the import duty is suspended until further notice are sugar, molasses, cereals, certain oil-seeds, fats and oils, condensed and dried milk, quebracho and other tanning woods and extracts, tar, mineral oils, certain metals, copper sulphate, litharge, red lead, casein, paper size and starch.

British India.—The valuations for the purpose of levying the export duty on the various classes of raw hides and skins are given in the issue for December 11.

British West Africa.—All export prohibitions on oils, fats, oleaginous nuts, seeds and products have been cancelled.

France (Algeria).—The consumption tax on alcohol has been increased.

France and Algeria.—As from December 5 the import of petroleum products is subject to authorisation to be issued by the Ministry of Finance on the advice of the "Commissaire Général aux essences et combustibles."

Germany.—The export of certain kinds of glassware and scientific instruments is prohibited, except under licence, as from November 22. The list includes optical glass, raw and ground; photographic apparatus; thermometers; apparatus and instruments of glass (including glass tubes); optical measuring instruments; precision balances; and chemical instruments.

Hungary.—Among the articles which may be imported without licence are many fats and oils, pyrites, gypsum, phosphates, asbestos, magnesite, china clay, camphor, essential oils, tanning materials, rosin, asphalt, turpentine, gums, tar (except lignite and schist tar), vegetable fibres, paper pulp, paper (except paper for spinning), cardboard, rubber, gutta percha, skins, leather, certain kinds of glass, china and earthenware, cement, roofing tiles, pig iron, iron and steel bars, rods, sheets and wire, common metals, solder, certain chemicals, fertilisers, glycerin, glue, rice starch, tar dyes, varnish, ultramarine, candles, soap, and wood matches.

Italy.—The articles affected by the increased statistical tax on imports and exports include oxides of iron, soda, sea and rock salt, crude sodium nitrate, sulphates of soda and copper, silicates of soda and potash, charcoal, metallic ores, iron and steel scrap, pig iron, certain kinds of iron and steel bars, rods and sheets, alabaster, marble, lime, cement, bitumen, graphite, earthenware, bottles and fertilisers.

Jugo-Slavia.—The articles that may be exported in any quantity without payment of export duty include medicinal plants, sumach, lime, magnesite, cement, pyrites, bauxite, antimony metal and oxide, sodium sulphate, calcium carbide, tartar, glue and fusel oil.

New Zealand.—Regulations under the Sale of Foods and Drugs Act affect baking powder, custard powder and cream of tartar substitutes.

Certificates of origin for goods exported from neutral countries in Europe are no longer required.

Spain.—The import duties on mineral oils have been reduced, as from December 1. The full text of the Decree is given in the issue for December 11.

A fee (*canon*) is to be charged on the export of hides, skins, leather, leather belting, etc.

A Royal Order has been issued under which licences will be granted under certain conditions for the export of a total of 20,307,514 kilo. of olive oil, to be valid until March 15, 1920, for hogsheads, and until May 1, 1920, for consignments in tins.

COMPANY NEWS.

CASTNER-KELLNER ALKALI CO., LTD.

The Right Hon. G. W. Balfour presided at the twenty-fourth annual meeting held in London on December 3. In moving the adoption of the report and accounts, he said that the net profit for the year (to September 30, 1919) was £190,655 (capital £1,000,000) and the available balance £239,474. Out of this sum it was recommended to place £50,000 to depreciation reserve, to make the dividend for the year 13 per cent. (the lowest since 1908), and to carry forward £51,876. The somewhat disappointing results of the year's trading were to be regarded as due to the abnormal conditions prevailing, *e.g.*, general uncertainty in the business world, demands for increased wages, and rise in the cost of raw materials. The sale price of the company's products had also risen, but not in proportion to the increased cost of production. A return to normal conditions, which appeared to be dawning, would remedy many, if not all, of the hardships undergone. With regard to the extensions undertaken for purposes in connexion with the war, the directors had arrived at a settlement with the Government under which some of them had been cancelled and the remainder was to be finished as and when required by the company's business. The latter had just been completed, and part of the cost was met by a Government loan repayable over a term of fifteen years. The board anticipated that the annual charge involved would be fully covered by economies in working. The large item of £664,485 due to creditors was made up of the Government loan and about £100,000 for excess profits duty in respect of the previous financial year. No excess profits duty was likely to be payable for the year under review.

The report and accounts were adopted unanimously, and the chairman and Prof. H. C. H. Carpenter, the retiring directors, were re-elected.

LIVERPOOL NITRATE CO., LTD.

At the annual meeting, held in Liverpool on December 4, the chairman, Sir Robert Harvey, said that the combined net profits of the company and the Colorado Nitrate Co. (with which it is amalgamated) were £84,354 for the year, compared with £132,874 in the previous year. The issued capital now stands at £64,800 in 253,200 shares of 5s. each, and in respect of these a total dividend of 7s. per share, free of income-tax, was payable for the year ended June 30 last. Owing to the stagnation in the nitrate trade a number of oficinas had to be closed down, involving great cost, but the amalgamation with the Colorado Nitrate Co. would enable work to proceed at the most economical rate of output. The present need for nitrate was urgent, but the available supply for the coming year would be very limited. The tonnage to carry it was confined to foreign-owned vessels, as British ships were not granted licences to load nitrate, and the unduly high freight rates were entirely to the benefit of the foreign shipowners. He was credibly informed that if the present restrictions were removed, much lower freights would be obtainable and the position of the British shipowner benefited.

LOW TEMPERATURE-CARBONISATION, LTD.

The annual meeting was held in London on December 16. The managing director, Mr. H. L. Armstrong, said that by the company's process the value of a ton of coal was virtually doubled. The products obtainable from one ton were:—Motor spirit, 3 galls.; other oils, 16 galls.; gas, 7000 cub. ft. of 600 heat units per cub. ft., after removal of light oils; sulphate of ammonia, 20 lb.; and smokeless fuel, 14 cwts. The working cost is less than that of other established processes, and the capital cost is lower. In view of the fact that the plant at Barnsley was operated from April to September with satisfactory results, several large schemes have been embarked upon. A contract has been arranged with an electric power company in Yorkshire to erect a plant and supply gas from 500 tons of coal per day, to be burnt in that company's boilers in place of raw coal. Negotiations have been entered into with an influential group of manufacturers in Scotland to provide enormous quantities of power gas from a "super-carbonising" station, the aggregate consumption of coal being estimated at 4000—5000 tons per week. Further, arrangements are practically complete for the erection of a plant near Sheffield to carbonise a minimum of 500 tons daily. Work upon the above plants is expected to start next year.

TRADE NOTES.

BRITISH.

Turks and Caicos Islands in 1918.—The salt and sisal industries in these islands are severely handicapped owing to lack of enterprise and capital. Salt manufacture is carried out by expensive and obsolete methods, and consequently the industry is not able to cope with foreign competition. The exports in 1918, 334,184 bushels of coarse salt (value £6,888) and 526,185 bushels of fishery salt (value £13,346), were the lowest since 1879, owing to shortage of tonnage. Stocks of salt in hand at the close of 1918 were estimated at 750,000 bushels.

The maintenance of the sisal industry was only made possible by the high selling prices prevailing. The East Caicos Fibre Company is to shut down next year, and no effort is being made to replant or to open up fresh areas for planting, in spite of the promising nature of the industry and the favourable climatic conditions. The value of the sisal exported during 1918 was £942, as against £5,950 in 1917.

Cotton appears for the first time among the exports of the Dependency, the value being £617 (which includes £257 for 1917). Efforts were first made in 1916 to induce peasants to take up the cultivation on systematic lines. The native cotton plants are hardy, free from disease, and possess heavy cropping qualities. The 1918 shipment sold for 1s. 8d. per lb., and was reported by the brokers to be of good quality and strength.—(*Col. Rep. Annual, No.* 1009, *Nov.* 1919.)

FOREIGN.

Wood Pulp Trade in Finland.—*Wood Pulp.*—Conditions in the Finnish wood pulp market, though critical in the early summer, improved when a reduction in prices was made and the German market re-opened. Practically the whole stock of wet wood pulp has been sold, and there has been no difficulty in disposing of this year's output: between June and August alone 40,000 tons of wet wood pulp was sold. Prices, however, have been lower than those obtainable in Norway and Sweden. It has been difficult to find a market for dry wood pulp, and of 18,000 tons sold 15,000 tons went to Germany.

Chemical Wood Pulp.—During the first half of the year the uncertainty of the Finnish political situation and the high prices compared with those in Sweden adversely affected the chemical wood pulp market. When the blockade was raised, however, large contracts were made with Germany, the

low Finnish exchange making it more advantageous for Germany to trade with Finland than with Sweden. On the whole, the Finnish chemical pulp trade has been able to hold its own in the market. During the first eight months of the year 37,500 tons of sulphate pulp was sold.—(*Bd. of Trade J., Nov.* 20, 1919.)

Trade of South-West Africa in 1918.—The Administrator of South-West Africa, in his latest report, states that there are indications that the territory is preparing to develop its industries on a commercial scale and in close economic association with the Union of South Africa. Imports during 1918, which were all derived from the Union, were valued at £1,031,534, the volume representing 3·1 per cent. of the total export trade of the Union. During the year diamonds were produced to the extent of 372,139 carats of an estimated value of £749,000. The Otavi Co. exported 7,358 long tons of copper ore, assaying from 12 to 33% of copper and 12 to 22% of lead. At the end of the year the company had on hand 139,322 long tons of ore with an assay value of from 2 to 41% of copper. The Otavi Exploring Syndicate exported 100 tons of copper ore with an assay value of 43.5% of copper. The Khan Mine closed down in February, and the Otjozongati Mine has not recommenced operations since the occupation. The output of tin amounted to 65 tons, assaying on the average 68%; 73 tons was exported.—(*Bd. of Trade J., Nov.* 27, 1919.)

Trade of the Philippine Islands in 1918—1919.—Full returns of Philippine foreign trade for the year ending June 30, 1919, show an import total of $107,774,263, an increase of 30 per cent. on last year's imports, but due to advances in prices rather than to increased trade. Exports totalled $122,729,238, of which less than 40 per cent. is credited to the latter half of the year. Hemp shipments for the first half-year were 96,380 long tons, and for the second half-year 36,268 long tons. This marked reduction of exports during the latter half-year is attributable to the depression in trade following the armistice. The manufacture of coconut oil has increased rapidly, and bids fair to become the chief industry of the Islands. As a natural result not only have copra exports ceased, but 17,093 long tons was imported during last half-year. With the release of tonnage and decline of freights following the armistice the sugar trade improved considerably, and local prices rose from 2·6 to 4·3 cents per lb. Exports at this latter figure were, however, small, owing to the failure of the crops.—(*Bd. of Trade J., Nov.* 20, 1919.)

REPORT.

Report of the Government Chemist upon the Work of the Government Laboratory for the Year ended March 31, 1919. *With appendices.* [Cmd. 419, 2d.]

The total number of samples analysed was 289,180, representing an increase of 20,062 over the previous year. The decrease of 16,000 in the number of samples examined at the central laboratory was due mainly to the cessation of hostilities and the consequent demobilisation of a part of the naval and military forces. On the other hand, a partial revival of trade, including the removal of restrictions on wine imports, led to an increase of 42,123 in the number of samples of wine examined. Other changes in the nature and volume of the work were a decrease of 4600 samples of army foodstuffs, and of nearly 3000 samples of steels and other metals for the Admiralty. The number of samples from the Food Controller and from the Air Board showed increases of 4813 and 3040, respectively, whilst the samples of coal received from the Coal Controller increased from 55 to 236.

The following numbers of samples were examined for the Customs and Excise:—Finished beer, 18,802; beer as retailed, 7; non-alcoholic beers, etc., 216; beer for export, 8425; imported beer, 29; materials used in brewing, 205; worts of unfinished beer, 8578; cider and perry, 18; table waters, cordials, etc., 183; spirits and spirituous preparations, 23,751; duty-free spirit, methylated spirit, etc., 1560; wines, 84,796; tobacco, snuff, etc., 69,768; tea, 7987; and many other substances. Eight samples of salts and solutions proposed to be used for treating brewing water were found to contain arsenic in excess of the permitted limit, but no excessive quantity of arsenic was present in beer made with water so treated; 966 samples of beer and wort examined were free from arsenic, and of 205 samples of malt and sugar, none contained arsenic in excess of the limit. The manufacture of saccharin in the United Kingdom, which had ceased for some years, was resumed in 1917, and 165 samples of saccharin and of the materials used in its production were examined in connexion with the assessment of duty.

Chemical work for the Admiralty entailed the analysis of 218 samples of food-stuffs and 5938 samples of metals, rubber, soaps, glass, and oils. Over 4100 samples, mainly alloys used in aircraft construction, were examined for the Air Board. The samples examined for the Board of Agriculture and Fisheries numbered 581. During the year no samples of imported fresh milk or cream were received; all the 47 samples of condensed whole milk analysed were free from preservatives, and there was no evidence that any of them had been prepared from skimmed milk. The 20 samples of imported butter examined were genuine and free from excess of water; 12 samples of imported cheese were free from foreign fats. Of 175 samples of butter submitted by the Department of Agriculture and Technical Instruction for Ireland, 32 contained excess of water, but all were free from foreign fat. The 167 samples analysed for the Local Government Board included baking powders, army rations, bread improvers, flour, fruit, pulp, preservatives, chocolate sweets and pastry; the chocolates contained mercury derived from the tin trays used in the process of manufacture, and the pastry had been made with a self-raising flour, in the preparation of which tartar emetic had been employed in place of tartar substitute. The Coal Controller sent 236 samples of coal, water, etc.; a sample of "coal saver" consisted almost wholly of common salt. Work for the Home Office consisted of the examination of lead glazes, paints, and other materials, and the analysis of samples received from the London police; the latter samples included drugs taken in connexion with the regulations limiting the use of cocaine and opium, liquors, etc. Samples to the number of 15,865 were examined for the War Department; these consisted of foods, beer and potable liquids, and drugs. The War Trade Department (now merged in the Board of Trade) submitted a great variety of samples taken by the Customs under the Exportation and Importation Prohibition Regulations; these samples consisted of soap (for glycerol content), disinfectants (for phenol), printing ink, ceramic colours and glazes, lubricants, rubber solutions, metals, coal tar oils, soldering fluxes, drugs, etc. The samples examined for the Office of Works, London, consisted largely of materials supplied by contractors for public service; numerous samples of materials used in the maintenance and construction of public buildings were analysed and samples of water from camp sites and for flax retting were examined. Ninety-seven samples were referred by magistrates under the Sale of Food and Drugs

Acts of 1875 and 1899. These included 82 samples of milk, 3 of whiskey, 2 each of ginger, Epsom salts and dripping, and 1 each of lard, cheese, chocolate, beer, camphorated oil and sausages. In 12 cases the results differed from those reported by the public analyst. Five samples of fertilisers and 6 of feeding-stuffs were submitted under the Fertilisers and Feeding-Stuffs Act. The fertilisers consisted of superphosphate, basic slag, and ammonium sulphate; the feeding-stuffs comprised feeding meals and cakes, milling by-products and poultry foods. Several of the meals contained substances unsuitable for feeding purposes.

REVIEWS.

COLLOID CHEMISTRY.

1. The Chemistry of Colloids. Part I., Kolloidchemie, *by* Richard Zsigmondy. *Translated by* E. B. Spear, *Associate Professor of Inorganic Chemistry, Massachusetts Institute of Technology.* Part II. Industrial Colloidal Chemistry, *by* E. B. Spear. A Chapter on Colloidal Chemistry and Sanitation, *by* J. F. Norton, *Assistant Professor of Chemistry of Sanitation, Massachusetts Institute of Technology.* (*New York: John Wiley and Sons, Inc. London: Chapman and Hall, Ltd.* 1917.) *Price:* 13*s.* 6*d. net.*
2. An Introduction to Theoretical and Applied Colloid Chemistry: "The World of Neglected Dimensions." *By* Dr. Wolfgang Ostwald, *Privatdozent in the University of Leipsic. Authorised translation from the German by* Dr. M. H. Fischer, *Eichberg Professor of Physiology in the University of Cincinnati.* (*New York: John Wiley and Sons, Inc. London: Chapman and Hall, Ltd.* 1917.) *Price:* 11*s.* 6*d. net.*

The publication of these two books, both translations of German works, while illustrating the continued and growing interest in the chemistry of colloids among English-speaking students, emphasises the lack of an adequate and satisfactory indigenous English literature of this important branch of chemistry. As the number of British workers in this domain increases, we may, however, hope that the gap in our English chemical literature will be made good.

The former of the two books mentioned above is a composite production, consisting, for the most part, of a translation of Zsigmondy's "Kolloidchemie," first published in 1912 and well known to students of colloid chemistry. To this, however, the translator has added a section of some thirty pages in length on Industrial Colloid Chemistry, and J. F. Norton a short chapter of some five pages on Colloids in Sanitation.

The work of Zsigmondy certainly deserved to be brought more fully to the notice of English-reading students on account not only of the authority with which the writer can deal with the subject of colloids, but also of the independent and characteristic outlook of the author. It is, however, unfortunate that the English translation should have been so long delayed as to appear just before a second and enlarged edition of the German work, and to be, in consequence, somewhat out of date already.

The work before us will probably not be found by students so useful as certain others for giving a general introduction to the properties of colloids. The work reads too fragmentarily and disconnectedly, and for this the classification adopted is, of course, mainly to blame. As no sharply-defined classification of colloids can be given, the author has adopted one depending on a chemical grouping of substances forming the dispersed phase of a colloidal system. After a chapter on "General Considerations" and one on Classification, the "Properties of Colloids" are dealt with in a chapter of less than forty pages, while another chapter of about fifteen pages is headed "Theory." After the more general treatment given in these four opening chapters the author discusses inorganic colloids—metals and non-metals, colloidal oxides, colloidal sulphides, colloidal salts—and organic colloids (especially soaps), dyestuffs, and protein bodies. These later chapters of the book are especially valuable from the practical point of view. Moreover, in his selection of material the author has confined himself for the most part to substances with which he has become familiar in his own investigations. If, thereby, restrictions have been introduced which make the book less valuable for the general student, the increased authoritativeness of the discussion enhances its value for the more specialist reader. Of special interest are the sections dealing with colloidal metals, particularly colloidal gold, in the investigation of which the author has taken an active part. With regard to the medical applications of colloidal metals, especially colloidal silver, the information is not very definite, and the review by Voigt of the state of knowledge in this department, although published some years ago, is not referred to here, as it did not see the light until after the appearance of the first German edition. This is only one of many cases illustrating the fact that the English translation as it stands is already rather out of date, and it is a pity that some attempt was not made to remedy this defect.

With regard to the section added by the translator on applied colloid chemistry, the reviewer, while recognising the importance of the subject, doubts the wisdom of the decision "to devote several chapters in this book to a side of the question that is particularly interesting to the technical chemist." Owing to the small amount of space allotted to this section, the treatment could not be anything but sketchy, and the author of the section has been compelled to omit considerable portions of the subject. The section, however, incomplete as it is, may in any case direct the attention of the reader to this side of the study of colloids, and will indicate something of the importance of applied colloid chemistry. In the chapter on "Colloids in Sanitation" it is also merely a glimpse that is afforded of this particular aspect of the subject.

The second volume under review is, as the author styles it, "a propaganda sheet for colloid chemistry," and is based on a series of lectures which the author delivered in the United States and in Canada during the winter, 1913–14. The work is a very useful one, more especially for the general reader, and also as an introduction to the fuller and more special study of colloids, because it is an attempt to give a general survey of modern colloid chemistry as a pure and as an applied science in a form readily intelligible to the general reader. It makes its appeal to the individual of general scientific culture, and the appeal is, on the whole, very successful. The subjects of the five lectures forming the basis of the book are: Fundamental properties of the colloid state; Classification of the colloids and the dependence of their properties on the degree of dispersion; Changes in state of colloids; Some scientific applications of colloid chemistry; Some technical applications of colloid chemistry. The field covered is a very wide one, the survey of the subject is very satisfactory and can be recommended to anyone wishing to obtain a general idea of what the colloidal state is and of the importance of this state in pure and applied science. It is, so far as the reviewer is aware, the only work of its kind.

The lectures were illustrated by specimens and experiments, and the author is to be commended for

giving full directions for carrying out the experiments shown. The book thereby acquires a greatly enhanced value for the lecturer and teacher. For such a person this book is to be recommended. It will be found of very great value.

ALEXANDER FINDLAY.

GRUNDLEGENDE OPERATIONEN DER FARBENCHEMIE. *By* H. E. FIERZ. *Pp.* ix.+323. (*Zürich: Schulthess and Co.* 1920 [1919].)

Of the four sections into which this highly practical treatise is divided, two are devoted to the fundamental operations involved in the production of coal tar intermediates and synthetic dyes; the third part furnishes technical details of the manufacture of these materials, and the fourth indicates methods of proximate analysis for the testing of the products. The chapter on sulphonation furnishes typical examples of the technology of this operation and includes also exercises in nitrations reductions and alkali fusions leading to the preparation of such important naphthalene derivatives as the naphthylamine-sulphonic acids and the technically valuable aminonaphtholsulphonic acids. To working descriptions suitable for operations on the laboratory scale the author adds useful memoranda concerning the carrying out of these preparations in the factory.

In the chapter specially devoted to nitrations and reductions one is glad to notice the substitution of cheap works recipes for the expensive academic methods of reducing nitro-compounds with tin and excess of acid or with alcoholic ammonium sulphide. The salting out of aniline from water replaces its extravagant extraction with ether.

Suitable examples of chlorination and oxidation are followed by the section on colouring matters, where a typical selection of azo-dyes is introduced.

A patriotic motive has prompted the author to add an interesting chapter on the synthesis of indigestion by Sandmeyer's method. This Swiss process, although no longer employed commercially, is a classical example of the combination of science and technology. It proceeds in five stages from aniline to indigo, giving an over-all yield of 80 per cent. of the calculated amount.

The section on technical details deals with distillation under diminished pressure, with the construction and employment of autoclaves, with the construction of the dye factory, and with other practical details essential to the successful management of a colour works.

The fourth and final section, which offers an introduction to the analytical control of coal tar intermediates might with advantage have been expanded so as to give a more detailed explanation of the analytical operations involved.

This treatise is profusely illustrated with plates and diagrams of apparatus and plants. The entire work is so completely up to date that it seems unnecessary to give it an incorrect date of publication ("1920"), a tampering with time which is not justified even by the most recent and advanced views on relativity.

This manual may be recommended with confidence not only to those making a special study of synthetic dye wares, but also to the general student of organic chemistry, to whom it offers a graduated series of laboratory experiments on the preparation of aromatic derivatives.

G. T. MORGAN.

IRON BACTERIA. *By* D. ELLIS. *With 45 illustrations and five plates. Pp.* 179. (*London: Methuen and Co., Ltd.* 1919.) *Price* 10*s.* 6*d. net.*

This book is designed mainly to assist the water engineer and chemist, by giving descriptions of the chief types of "iron bacteria" at present known, and by indicating the manner in which the knowledge so far gained may help in dealing with the attacks of these organisms.

From the point of view of the bacteriologist it must be admitted that our knowledge of this physiological group is scarcely sufficient to warrant a treatise, but Dr. Ellis's book reviews the present state of the subject, gives a useful list of the literature, and should serve to draw attention to the need for further research.

In the first portion of the book the author describes the various types of "iron bacteria" commonly met with, and gives diagrams and microphotographs illustrating their morphology. As in the case of many other bacteria, a good deal of uncertainty exists as to the specific distinctness of the various forms. For example, the group of *Leptothrix ochracea* and its allied forms *Gallionella* and *Spirophyllum* differ in the twisting and shape of the threads, and the author inclines to the view that they are variations of a single type. It would seem that further cultural study should enable this point to be settled. A similar example is seen in the case of *Cladothrix dichotoma* and its related forms.

However, the chief interest in connexion with the "iron bacteria" is centred round the physiology of their nutrition. The author devotes a chapter to the consideration of the various theories connected with the deposition of iron oxide by the organisms. General attention was first drawn to the subject by Winogradsky's theory, that they derived energy by the exothermic reaction involved in the oxidation of ferrous to ferric compounds. This theory, supported chiefly from an analogy with the sulphur bacteria, has been largely discredited since the behaviour of *Leptothrix* in pure culture was studied by Molisch, who showed that a ferruginous medium is not essential, but that the organism will grow as a saprophyte in the presence of organic matter, and that the presence of this organic matter is essential to its growth.

Molisch has suggested that the iron bacteria make use of organic matter which is in combination with an iron radical, casting out the iron as hydroxide. However, as the author points out, if we accept this theory, we must assume that the organisms possess an exceptional affinity for organic iron compounds. Until the possession of this power has been demonstrated the question of their metabolism cannot be regarded as settled.

The book contains two chapters dealing with the practical aspect of the subject and the detrimental effects of the organisms in reservoirs and waterpipes is described. The author suggests curative measures chiefly depending on the oxidation of the organic food material in the water and on the formation of an alkalinity unfavourable to growth by the addition of lime. At present, however, it is only possible to indicate the broad lines upon which treatment may be effective, and more research is needed before curative methods can be perfected.

H. G. THORNTON.

PUBLICATIONS RECEIVED.

THE CHEMICAL ANALYSIS OF ROCKS. *By* HENRY S. WASHINGTON. *Third edition, revised and enlarged. Pp.* 271. (*New York: John Wiley and Sons, Inc.; London: Chapman and Hall.* 1919.) *Price* 11*s.* 6*d.*

THE PREPARATION OF ORGANIC COMPOUNDS. *By* E. DE BARRY BARNETT. *Second edition, with 54 illustrations. Pp.* 273. (*London: J. and A. Churchill,* 1920). *Price* 10*s.*

INDUSTRIAL GASES. *By H. C. Greenwood. Pp.* xvii.+371. (*London: Baillière, Tindall and Cox.* 1919.) *Price* 12*s.* 6*d.*